SCIENTIFIC AMERICAN

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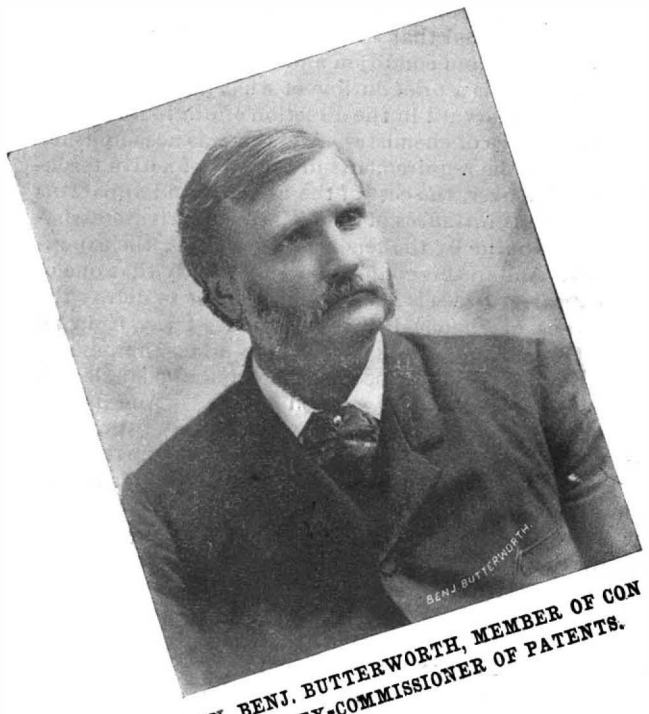

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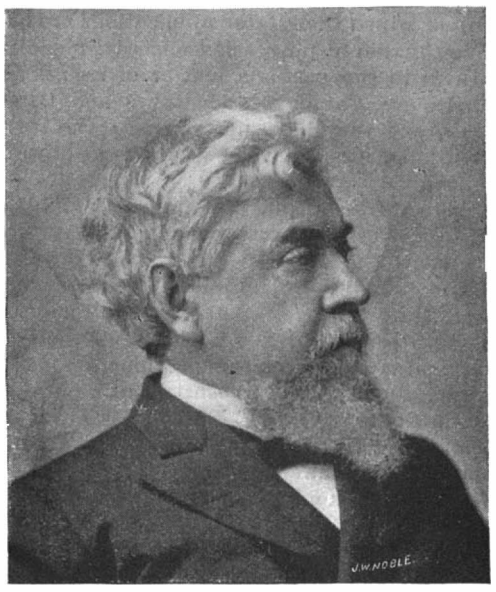

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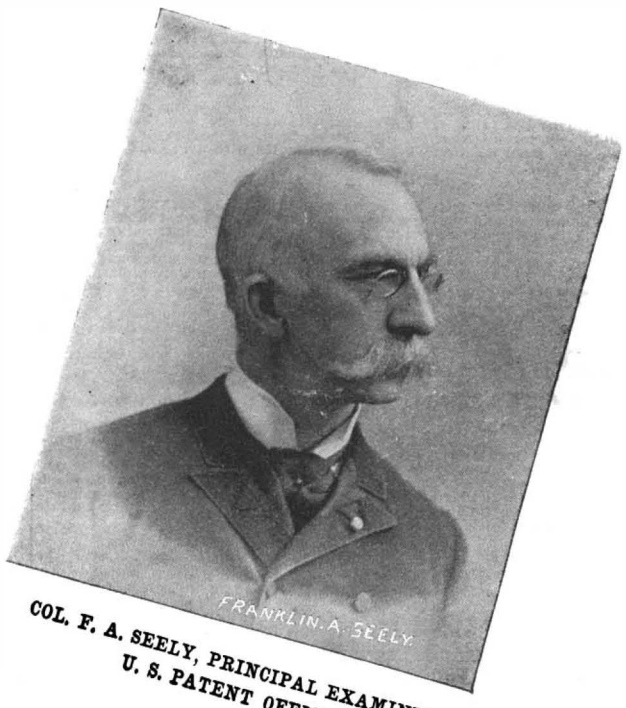

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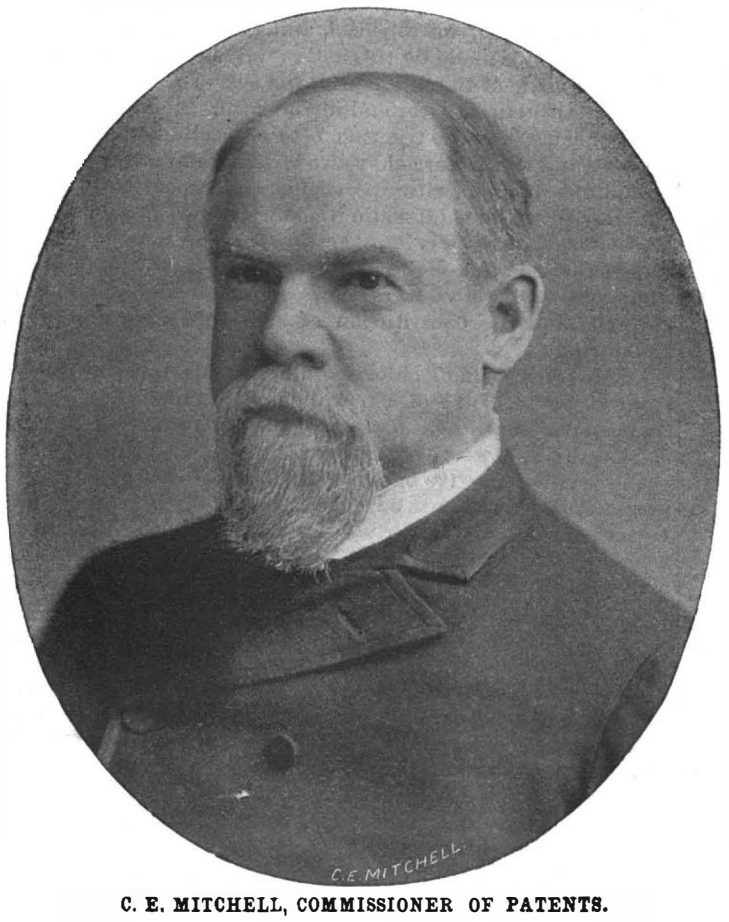

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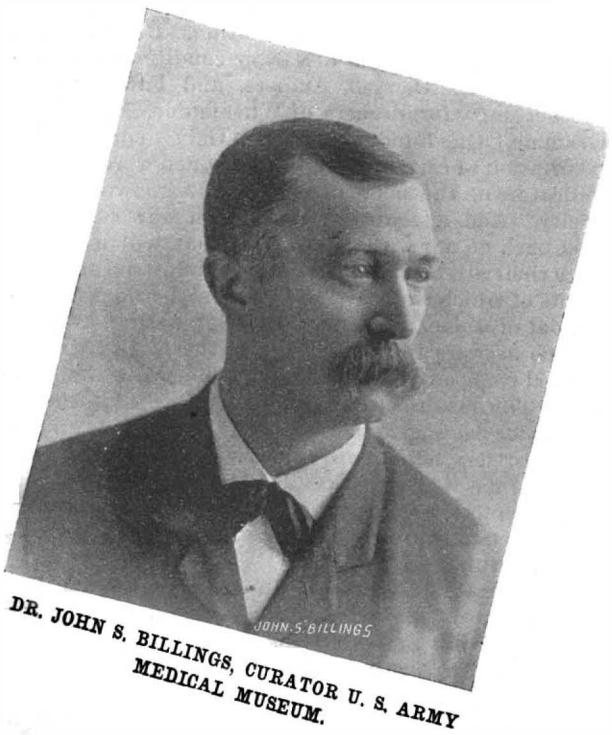

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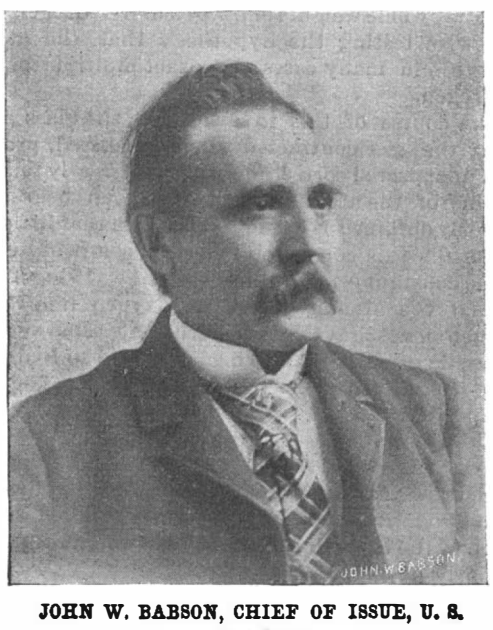

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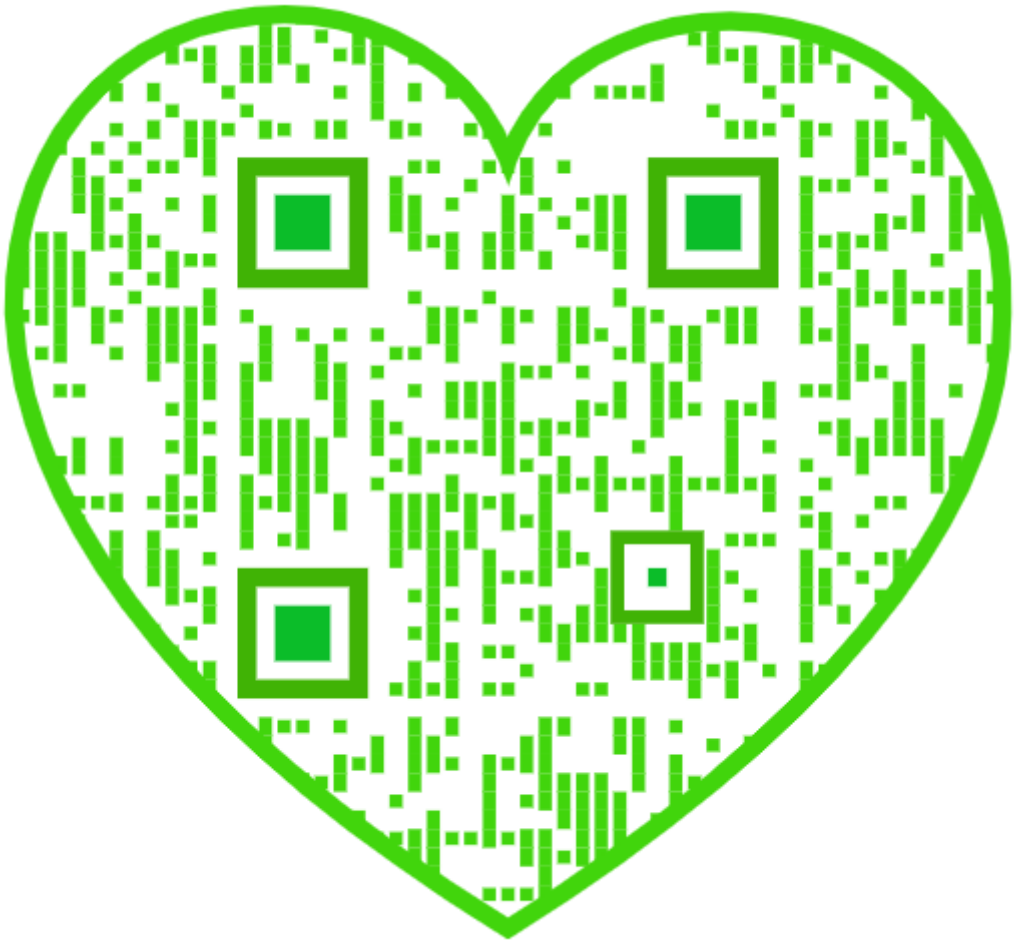

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ORIGINAL WORK IN AMERICA.

"Americans are the best mechanics in the world." This assertion was recently made by an English scientific journal of high authority, and so true it was that it has remained uncontradicted. Indeed, European journals abound with descriptions of American accomplishment in the domain of applied science, and the detail of American practice and American criteria prevail to a very important extent in European workshops. But though we have worked this field so persistently and successfully, though we have designed with cunning skill so many devices to lighten the labors and increase the convenience of the human family, much of the credit belongs to the old world, for it was there the laws were discovered or rather interpreted upon which these later applications are based. That investigation in pure science has been sadly neglected here in the past is a matter of record. Perhaps there are Faradays and Davys and Oersteds among us, but they have not come to the surface. Such men labor for the love of science; we have been after dollars.

That there are keen and well prepared minds and cunning observers among us, no one will doubt who has listened to the discussions of some of our scientific bodies, notably the National Electric Light Association. Many look to the universities for discoveries in pure science, and with a view to discover what original work, if any, is being done among them the SCIENTIFIC AMERICAN recently sent a representative. Following is the result of his investigations, the same being as nearly as possible in the language of the scientific men interviewed:

Dr. Josiah P. Cooke, Erving Professor of Chemistry and Director of the Chemical Laboratory, at Harvard, said: The investigations in chemistry conducted during the present year are largely continuations of those of last year; but for obvious reasons we are not yet in a position to judge fully of the results. Under the direction of Prof. Jackson, researches are being conducted in several different subjects. Among these are the study of the reaction between sodium maloric ester and tribromtrinitrobenzol, and also work on the new compounds made by this action. Some study has also been made of the products of the action of sodium acetacetic acid upon tribromdinitrobenzol. A study is also being made of the reaction between sodium maloric ester and the latter acid; also a research on tetrabromdinitrobenzol, with particular reference to its action with aniline and sodium maloric ester. Under Prof. Jackson's supervision, also, three seniors of the college carried on a series of experiments in aromatic compounds, whereby several new compounds were discovered, and the constitution of some old ones determined.

The investigation of chlorpyromucic acids was continued by Prof. Hill and a new dichlorpyromucic acid was discovered, whose constitution has not yet been ascertained. It is worthy of notice, however, that this is the first representative of a class of disubstituted pyromucic acids which must be either structurally isomeric with the two forms formerly observed or geometrically isomeric with one of them.

By experiments conducted under the direction of Prof. Hill upon the so-called dioxymaleic acid, it was found that pure dibrommaleic acid yielded nothing but acetic acid and carbonic dioxide under the conditions described by Bourgoin.

The pyromucic acid used in these investigations was made from a crude furfurol found among the products of the dry distillation of wood. The higher boiling portions of the oil have also been studied, and although the experiments have not yet been completed, the presence has been established of a methylfurfurol boiling at 186° to 187°, which can readily be converted into a methylpyromucic acid by oxidation.

A few years ago, I sought, with the assistance of Dr. T. W. Richards, to determine accurately the ratio between the atomic weights of oxygen and hydrogen, with the view of testing the hypothesis that the atomic weights are in many cases the exact multiples of that of hydrogen.

In the course of this investigation, the glass globe holding the gas contracted when exhausted, producing an unexpected correction, which so greatly reduced the value of the atomic weight of oxygen below that previously obtained as to suggest the idea that in former experiments this correction had been compensated for by some constant error still undetected. Owing to the fact that the atomic weight of oxygen referred to hydrogen must have, very nearly, the same value as the specific gravity of oxygen gas referred to hydrogen gas, it seemed advisable to redetermine this last constant by a process not involving the exhaustion of the globe in which the gases were weighed.

I devised a method for this purpose, and I have been engaged this year in working out the details which the new method involved. This work has resulted in verification of the low value of the atomic weight of oxygen previously obtained.

A series of interesting observations were conducted by Dr. O. W. Huntington, on certain features of crystalline growth, which bear an important relation to the subject of the origin of meteoric bodies. Previously he had shown that a continuity could be traced between ordinary octahedral and so-called cubic irons, and this led to the inference that both had the same structure, and that they differed only in having a more or less coarse grained structure, depending on the rapidity of the cooling of the originally molten mass. Later observations have confirmed this inference, and it is now evident that while the outer portions of the large Cohahuila meteorites have all the characters heretofore associated with a cubic structure, the interior of these masses is filled with Widmanstattian plates, and when exposed breaks into small octahedral plates. The transition from rapid to slow crystallization is shown on the face of a large slab cut through the center of one of the masses. From these observations it would seem that there is a certain individuality in the masses and that the meteors were launched into space in a molten condition and cooled each by itself.

The above is a brief outline of what has been accomplished at Harvard in the direction of original research in the science of chemistry. And this was accomplished in spite of the requirements in the way of active teaching. Moreover, the cost of the material and apparatus and in some instances of the salaries of private assistants was borne by the teachers conducting the experiments. And in this connection I would say that one of our greatest needs is a small endowment to defray the expenses of chemical investigation. I say it in no boastful mood, but it is nevertheless a fact that among the English-speaking people there is not a single university which can show as good a record. And in Germany, of which so much may be said regarding the encouragement of original research in chemistry, it is at only two or three centers of activity that this record has been greatly surpassed.

The functions of a university are to act as an educator of youth and to serve as a source of knowledge. These functions are mutually dependent yet essentially distinct. Until recently an idea was current that in most departments teaching was the only occupation for which the professors were paid. This idea had its origin in the circumstance that the teachers were mainly supported by the fees of students. I do not for a moment question that in an American college a prime condition of the institution's success is the best of thorough teaching; and that we have not neglected our duty in this respect is evident from the large number of students now studying at our desks.

But the officers of a university should be actuated by a higher spirit than that of a mere pedagogue, and in this respect there has been a noticeable change during the last few years in the attitude of the university toward original research. The value, material and moral, arising from the discovery of truth is universally admitted. Scholars in a university are properly engaged only when searching for abstract truth; that is in searching for truth for truth's sake, rather than for devices for industrial appliances. That this value of pure scientific truth is not appreciated fully in the United States is a lamentable fact; and it is often the case, even in the reading of a paper before a scientific society, that the technical forms in which results are stated are often received with a smile. But the abstract truths of one generation is the practical knowledge of the next.

The magneto-electric machine, a purely philosophical instrument made by Faraday in 1831, has developed into the dynamo of to-day. The discovery by Oersted in 1819, that a needle is deflected by an electric current, became the basis of Wheatstone's telegraph in 1838. And so in chemistry purely theoretical investigations of the products of the distillation of coal tar have created new branches of industry and revolutionized the old arts of dyeing and printing. Undoubtedly, theoretical study is the necessary condition of industrial progress. Oersted, Ampere, and Faraday were the necessary forerunners of Wheatstone, Morse, and Gramme. One hundred years ago Galvani published a description of certain phenomena, which were the first indicators of the mode of energy now known as electricity. And a century hence, when our successors look back on our work of to-day, what will most engage their attention is not the great industrial achievements of which we boast, but the conscientious following out of some mysterious hints of nature, as mysterious as were the twitchings of the frog's legs suspended from an iron balcony in Bologna in the year 1787. The enthusiasm of the true-hearted scientific investigator has also an immediate value. It has an important reflex action on education. Certainly direct teaching has its legitimate place in the details of college discipline, but education is not solely a question of instruction, but fully as much, if not more, a question of enthusiasm.

The highest inspiration can come only from the teacher who is himself a student ever searching for the underlying and vivifying truth at its original sources, which, for the student of science, must be the ever-open book of nature. Compared with this overruling spirit, the number of courses of study is a matter of secondary importance.

If, then, it is true that the function of the university

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is to serve as a pioneer in original investigation, no cost can be too great which is required to facilitate these studies. But while the colleges of this country have vied with each other to increase the facilities for instruction, they have done almost nothing to encourage the higher work of their professors, and what has been accomplished for science and scholarship is due solely to the untiring efforts of devoted men working under adverse circumstances and against great odds.

A college professor cannot successfully conduct any of this work unless his occupation of teaching leaves him sufficient leisure of energy as well as of time. No original work can be expected of a teacher whose energy has been exhausted in the class-room. Moreover, in conducting scientific investigation, it is all important that the attention should be engrossed with the work. To secure the best result whole days or weeks should be left otherwise unoccupied, and if this object were regarded as of primary importance, the colleges might easily conform their exercises to meet this requirement. On the other hand, however, a limited amount of teaching is a help rather than a drag to the investigator.

But in the distribution of work, a far greater economy of resources might be used than is usual in our colleges. To employ trained veterans to do drill work which could be done equally as well by younger men is as great a waste of skill as it would be to set a cabinet maker to frame a house. If the administration of our colleges relieved their experienced professors from drudgery by transferring elementary instruction to young men, the efficiency of these institutions as sources of knowledge would be greatly augmented. But, even if relieved from the irksome work of elementary instruction, our college professors cannot secure the largest results as producers of knowledge, unless they are provided with the assistance required to carry forward with success the work of investigation. In all departments of experimental science original research involves an immense amount of purely mechanical labor. Mechanical difficulties have to be overcome, and the resources of every art and trade are called into requisition. To those who are accustomed to secure a return proportionate to the labor expended, as in most literary enterprises, such work would be utterly discouraging. We spend days and weeks to find the cause of an anomaly in our results, and discover at last only an impurity in our materials or a leak in our apparatus. Thus it is that the mere physical labor in a chemical experiment becomes so great. As well expect an architect to build with his own hands the house he had planned as to expect the experienced chemist or physicist to do the mechanical work which his investigations require. The productiveness of our universities as centers of thought can never be brought up to the higher interests of the community until provision is made for supplying with necessary assistance those who are capable of directing scientific investigation. We should never have been able to accomplish the work that has been done in our laboratory had we not been able in a more or less irregular or spasmodic way to secure a limited amount of excellent assistance. Some advanced students have been willing to give their labor for such small pecuniary remuneration as will enable them barely to live at the university. This mode of securing assistance is objectionable for several reasons. No dependence can be placed upon it, and the assistance is constantly wanting when most needed. A large university should provide and organize the assistance required by its working professors just as efficiently as it actually does its instruction. Of course, to do this requires endowments. The only department where the endowments are adequate for the purpose is the observatory, and its large contributions to astronomical science is the natural result of the large amount of assistant labor it employs. There are just as large problems in physics and chemistry, and just as important ones for the advancement of knowledge as in astronomy, but these have to wait for the want of such endowments as the older and more popular science readily secures. At this moment there is a very important problem in chemistry which corresponds to the great problem of mapping out the stars, with which so many astronomical observatories are occupied, and that is the determination of the accurate values of the atomic weights. A great deal of work has been done on that problem in our laboratory, and a plan has been devised for carrying forward the investigation, which cannot fail to bind the results obtained into a consistent whole, but the plan lags for want of laborers. Our laboratory has actually no endowments, and the cost of all scientific work, except actual instruction, must be borne by those who seek to extend the boundaries of knowledge.

Some years ago a plan to endow research was drawn up and submitted to the criticism of several prominent men of science in this country. The plan contemplated supporting with large endowments a body of trained experts wholly devoted to scientific investigation, and the interest which it aroused plainly indicated the national importance which was attached to such work. It seems to me that the chief defect of the plan was to connect the endowments with the universities or other existing educational institutions. It is not possible to secure by any system of competition first-class investigators, and endowments distributed on such a basis would lead only to commonplace results. Like the poet, the investigator is born, not made, and the higher educational institutions are the places where such powers are naturally discovered and developed, and they afford the best field for its exercise. I believe that the most effective method of endowing research would be to multiply at the larger universities professorships, with strict limitations as to the amount of teaching that could be required, and with an income sufficient to pay for assistance and defray all other costs of investigation. I should recommend that such professorships be open at large to any one who had special aptitude for investigation.

Another condition of successful investigation is freedom from anxiety in regard to means of support. The divine afflatus is rarely accompanied by wealth, and the investigator must live, and live decently. The average salary of the schoolmasters of the country is better than that of the professorships in most of our colleges, and it seems strange that recruits can be had for such positions; but, in fact, they are eagerly sought, and by a class of noble and devoted men. Students who in our laboratory acquire an enthusiasm in the pursuit of truth will constantly give up every chance of pecuniary gain and take a position where they can devote their life to study, provided only it promises a bare support. Their first question in regard to an opening is not what is the salary, but what are the facilities for investigation. The world would profit from the labor of such men if they were relieved of all pecuniary anxiety.

Large salaries are not expected, indeed are not desirable. It is not best that men should be led into such a career who have not so marked a call that they are willing to sacrifice to it the larger emoluments of professional success.

(Further talks with professors of Harvard and other universities will follow.)

MISCELLANEOUS NOTES.

To what extent may mechanical designs be copied? From a legal standpoint the answer would be: Only up to the point of infringement. But in the current practice in the machinery trades, unless the design be wholly novel, little, if any, objection is made to infringement in the line of improvement. Hammers, saws, chisels, files, and the like are constantly undergoing changes in design; he whose design is improved upon borrowing the improvement, adding something to it, and selling it as his own; another taking it from him by similar means, and so on. A large manufacturer of machinery said to the writer recently: "It doesn't pay to bring suit save where the interference is very clear. Saws and planers and drills and the like have been made time out of mind, their principles having been utilized in a thousand and one ways. Even where one of our draughtsmen leaves us and goes to a rival house, carrying many of our ideas with him to be worked out with close resemblance to our own designs, it scarcely pays to fight. We take the result and make as much improvement as we are enabled to and let it go at that. The machinery trade generally is doing the same, the result being as usual—the man with the longest pole gets the most persimmons."

Too much cavalry, so it is claimed, is a serious defect of the German war establishment. Indeed, a suggestion of reducing the present force of 64,162 troopers and 62,469 horse one-half is now being seriously considered by the general staff. "Cavalry armed with sword and lance, like the uhlan," says a general of division, writing on the subject, "is more likely to encumber an army than to advantage it." He reviews the history of recent wars to prove the utter fatuity of pitting mounted men against infantry, citing the failure of the cavalry at Milaslaw, Wiesenthal, Balaklava, Solferino, Worth, Mars la Tour, Beaumont, etc., to prove his point. His mention of Balaklava, it is evident, refers to the charging of the Light Brigade upon a Russian battery, this having always been regarded as a great blunder, the result of a misunderstanding of orders. On the other hand, the charge of 500 men of the heavy brigade, under Col. Scarlett, was a remarkable triumph for the trooper, but not, however, over infantry. "The improvement in small arms," continues the general, "has led to the abandonment of the old bayonet drill. A man who started at a distance of 1,000 paces to attack an enemy with fixed bayonet would be regarded as a candidate for a lunatic asylum. What, then, of the cavalryman, who offers six times the front to marksmen, who cannot take advantage of the protection afforded by the contour of the country, but who is expected to advance in solid array on an enemy 3,000 paces distant?" He believes it to be the province of cavalry to reconnoiter and force an unestimated enemy to show his strength, and would have wagons carrying infantry to storm fortified places during aggressive reconnoitering. As to opposing cavalry with cavalry, he does not believe in it; insisting that infantry fire is the best physic for charging troopers.

Electricity for passenger service, steam for freight trains. That, so some good authorities declare, will be the apportionment of the rival energies on the railroad of the future. Steam at high speed requires quantities of coal and water, thus largely increasing the weight to be carried, while the wear and tear of the generating apparatus is thought to be almost doubled when continuously forced. With electricity, on the other hand, it is quite otherwise. The faster you go, the greater is the economy over steam. Indeed, as the speed increases the relative value of electric propulsion increases enormously, an expert before a recent meeting of the Institute of Electrical Engineers declaring that at 120 miles an hour it is something like six times more economical than steam. "If," said he, "you can get 90 per cent efficiency out of your electric service and have a frequent service at 20 miles an hour, electric propulsion is even then slightly more economical than steam propulsion." One of the best known electric motor manufacturers recently declared it to be his belief that in the future express trains between populous centers like New York and Philadelphia would consist of two electric cars, to be started every ten minutes, and running at a speed of a mile a minute.

The Electric Transmission of Power.

Switzerland seems to have taken the lead of all countries in adopting the system of electric transmission of power in a large way and for all purposes. Mr. Gasper Kapp, in a recent lecture before the British Society of Arts, gives some most interesting details, including cost, of the principal installations, as follows:

Distance in Miles.	Horse Power Delivered.	Speed of Machines.	Cost in £.			Total Cost.*	Cost per Horse Power.
			Generator.	Motor.	Line.		
						£	£
1·870	85	450	640	560	440	1880	22·2
0·280	195	500	760	680	132	1800	9·7
0·280	51	600	320	280	60	720	14·1
0·375	90	550	520	480	80	1240	13·8
0·560	71	600	440	400	60	1040	14·6
0·280	40	700	260	240	20	640	16
0·375	75	600	480	440	68	1120	15
0·500	87	500	520	480	100	1260	14·5
1·560	150	600	760	720	330	2050	13·7
0·220	93	450	440	420	232	1270	13·7
6·250	11	900	132	110	480	960	87
2·200	51	600	360	320	300	1140	22·4
0·187	60	900	240	220	18	600	10
5·000	41	750	240	200	344	1020	24·8
3·750	220	600	1040	960	640	2960	13·5
0·002	15	600	112	104	8	252	16·8
0·250	19	700	160	160	20	390	20·5

*This includes regulating apparatus, instruments, posts, insulators, lightning arresters, erection, and supervision.

At the Schaffhausen Spinning Mills a larger plant than any of the above is being erected, to have five turbine wheels of 350 horse power each, of which three are in position and two are in use. Four cables are employed, each having 0·437 of a square inch section, and they are carried on towers across a river span of 336 feet. At the power station there are two dynamos of 300 horse power over-compounded, and there are three motors at the mill, one a twin machine of 380 horse power, and two of 60 horse power in different parts of the premises. The commercial efficiency of the plant at full load is 78 per cent; it is guaranteed to have a capacity of 20 per cent in excess of the normal for 1½ hours; the brushes wear 2,000 hours, and the commutator 20,000 hours. The cost of the installation was $68 per horse power delivered, and the cost of power is $14 per horse power per year at the rope pulley of the turbine.

The Iron Port of the World.

Escanaba is the county seat of Delta County, Michigan. It lies at the foot of the great pine forests, and overlooks Little Bay de Noquet, the headwaters of Green Bay. Five years since it was practically a village in the wilderness. To-day finds it a city with a population of 8,000, lighted by electricity, having a well equipped fire brigade, waterworks with a capacity of 4,000,000 gallons per day, a high school and three other schools, six churches, three newspapers, a railway station where 216 trains arrive and depart daily, and it will shortly have an electric street railway in full work. Its annual retail trade is estimated at $3,000,000, and its wholesale trade, including iron ore, pig iron, lumber, and coal, at about $25,000,000.

According to Mr. Nursey's carefully written report, capable of the fullest verification, Escanaba is the greatest iron port of the world. He tells us that during the navigation season of 1890 it shipped 3,700,000 tons of iron ore, or nearly double that of all the ore ports of Michigan, Wisconsin, and Minnesota combined. Its lumber output amounted to about 120,000,000 feet, while the freight capacity of the vessels entering and clearing from its port exceeded 8,000,000 tons. This compares with the tonnage of the greatest seaports of the world, which are: (1) London, 19,000,000; (2) Liverpool, 14,000,000; (3) New York, 11,000,000; and next comes Escanaba with 8,000,000 tons.

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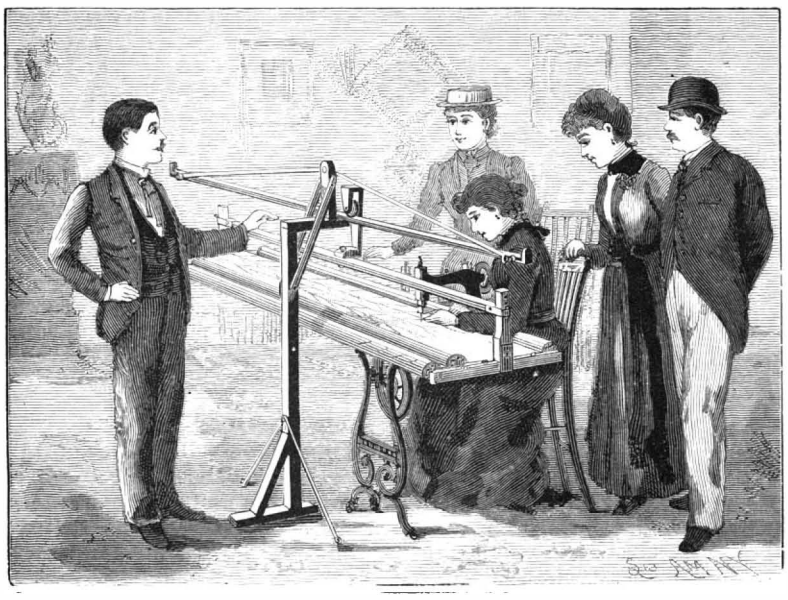
Wood Pulp.

Wood pulp making by the sulphite process is thus briefly described: The wood is peeled, discolored or decayed parts are removed, the wood is cut across the grain into thin chips, which are elevated to the top of the mill and dropped into large drums about 14 feet in diameter, 24 feet long, and strong enough to sustain a pressure of from 75 to 200 pounds to the square inch; when packed full of chips the drum is filled with sulphuric acid and other chemicals, and the cotton-like product is pressed dry and mashed, mixed with water, rolled flat, and cut into shape for bundling, being 60 per cent moisture and 40 per cent fiber. Thus it goes to the paper mill. One cord of spruce makes 1,200 pounds of dry fiber, worth from $1 to $1.50 a hundred pounds. Freight is paid on the water contained rather than use dry pulp, which packs hard. A sulphite plant that will consume from 8 to 15 cords of wood every twenty-four hours will cost about $10,000.



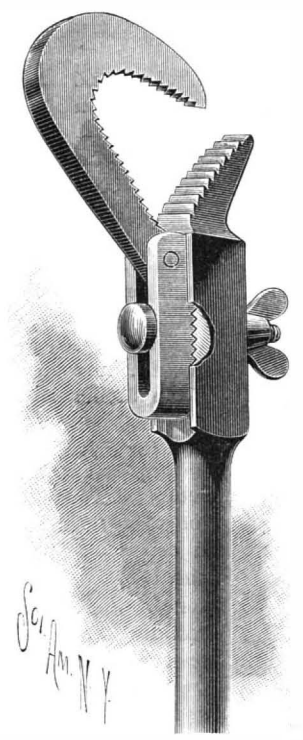
TOUCHSTONE'S QUILTING FRAME FOR SEWING MACHINES.

A QUILTER FOR SEWING MACHINES.

The illustration represents a device designed to be easily and nicely adjusted to hold a quilt in convenient position for work upon it, and so that it may be readily adapted to the feed of any sewing machine. It has been patented by Mr. James N. Touchstone, of Ida, Texas. A properly braced standard resting upon the floor has a forwardly extending arm carrying a vertical post connected by side braces with the standard. Upon the projecting end of the arm rests the central portion of a cross beam or track having its upper edges beveled to receive a pulley, the track having an end stop to prevent the pulley block from running off, and rods extending from each end to a pivotal connection with the upper end of the vertical post, whereby the track may be tilted to any desired inclination. A pulley block with a grooved pulley is carried by the track, and through the lower portion of the pulley block extends a vertical bolt, on which is pivoted a cross beam, at each end of which is a loop adapted to receive an upright of the quilt-holding frame. By the insertion of a bearing pin in one of several holes in the upper end of the uprights the latter may be readily adjusted as to height, and at the lower ends of the uprights are loops, through which extend the end pieces of the frame, in which are journaled three rollers adapted to support a quilt placed thereon in the usual manner. The rollers have at one end perforated disks adapted to be engaged by latches, whereby the rollers will be held from turning, except when the latches are disengaged. With this construction, the frame supporting the quilt may be readily brought into any desired position, the suspended frame moving freely, and the device permitting of such arrangement in connection with a sewing machine that the feed of the machine will draw the quilt and frame through it. This quilter is designed for adaptation to all family sewing machines, for the quilting of any desired pattern.

AN IMPROVED WRENCH.

A wrench which is simply and strongly made, and is readily adjustable to grip larger or smaller work, is shown in the cut, and has been patented by Mr. Benjamin B. Farris, of Rocky Ford, Ga. The stock has an angularly extending fixed jaw, provided with serrations, and on one side of the stock are serrations as shown in a broken-away portion in the picture. The serrations in the side of the stock are engaged by corresponding serrations on the inside of a head sliding between two parallel flanges at the edge of the stock. A bolt, passing through a longitudinal slot in the stock, secures the head thereto in the desired adjustment, and in the outer end of the head is pivoted a hook-shaped, serrated jaw. When the head is in the proper position, the work is engaged at one side by the serrations of the fixed jaw, and as the operator turns the work the hooked jaw has a tendency to be firmly drawn toward the fixed jaw, so that the wrench does not slip on the work.

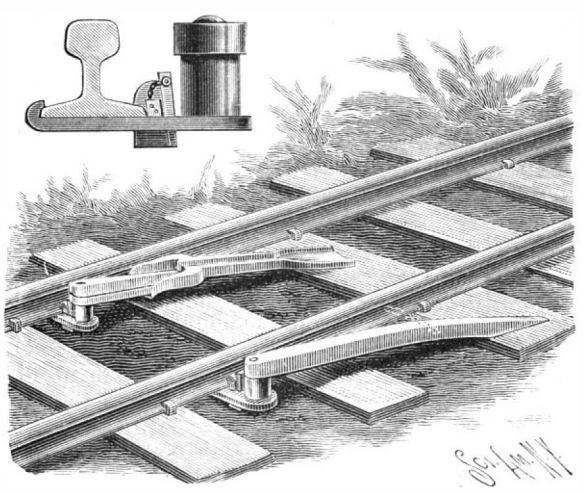


FARRIS' WRENCH.

A READILY APPLIED CAR REPLACER.

The device shown in the accompanying illustration, which has been patented by Messrs. William Stephens and Joseph Mott, is designed to afford a ready means of replacing a derailed car or engine upon the track at any point in the length of the road. An outer and an inner frog or skid are provided, each made in two sections—a bar or track section and a base section for securing the device to a track rail. A sectional view of the device applied to one rail is shown in the small figure, the base plate having at one end a flange gripping the flange of the rail base on one side, while an adjustable clamp and key, projected through an aperture in the base plate, are adapted to clamp the device on the other side of the rail base, the key being attached to the clamp by a small chain. The bar or track section is pivoted at one end to a short post at the other end of the base section, and is curved downward and flattened on its under face to rest upon a tie, a pin or pins in its flat under face being adapted to enter the sleeper and retain the track section in fixed position. In the inner frog or skid, the upper face of the track section is provided with side flanges, each of which has an angular recess, while a switch point is pivoted to the pivotal end of the section, and adapted to be swung into or to enter either of the recesses, according to the direction in which the switch point is to be thrown. Attached to each skid near its lower end is a suitable length of chain having at its free end a double hook for engagement with a rail flange when the device is placed in position.

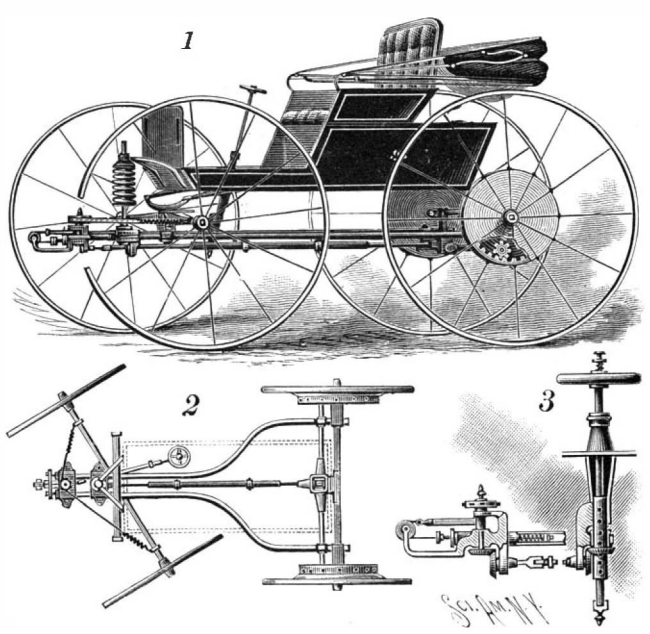
For further information relative to this improvement address the inventors, Redding, Cal.



STEPHENS & MOTT'S CAR REPLACER.

A PROPELLING MECHANISM FOR VEHICLES.

This is a further invention of Mr. M. A. Libbey, of South Berwick, Me., for an improved vehicle, styled by the inventor the "Princess of the Highway," described in our issue of March 14. It is designed to afford a strong and light tubular construction containing frictionless, telescopic, ball-bearing slides and balanced steering and driving gear, adapted for application to ordinary light road vehicles, to the varying lengths and widths of which it is adjustable. Fig. 1 is a view in perspective of a vehicle provided with this mechanism, Fig. 2 being a broken plan view, and Fig. 3 an enlarged detailed sectional view of the steering mechanism. The power by which the vehicle is propelled is applied to a vertical shaft having its bearing in a bracket projecting forward from the front end of the wagon body, a solid collar, forming the upper end of a stiff spiral spring, being firmly connected to the shaft, while the lower end of the spring is fixed to the flange of a tube on a shaft in a frame connected with the front end of the reach rods, a depending arm from this frame carrying the connecting rod which drives the rear wheels. The spring on the power shaft is not intended to yield vertically, but is adapted to spring laterally, to allow for the swaying of the vehicle, the spring being turned like an ordinary shaft. Clamped to each of the rear wheels are annular flanges with inwardly projecting flattened rims, the flanges having a rib extending around their inner surfaces and being provided with recesses or indentations, while a circular gear is adapted to fit closely within the flanges, to abut with the rib and receive the indentations. The gears are adapted to mesh with pinions on transverse shafts, so that when the pinions are turned, the rear wheels will be revolved. A hollow shaft, carrying at its top a hand wheel or handle bar, extends upward through the wagon body in front of the seat, the lower portion of this shaft being connected with a forwardly extending steering mechanism, whereby the forward wheels and axle may be turned to one side as desired, as shown in Fig. 2. The main parts of the mechanism are inclosed, so as to be unaffected by mud and dust, and the driving parts are designed to remove the weight and strain from the axles and place the weight in continued suspension on the circumference of the advancing half of the drivers. Other modifications of the invention, on the same general principle, are designed for application to heavy passenger vans, etc.



LIBBEY'S DRIVING DEVICE FOR VEHICLES.

Wesley's Electricity.

While the religious sect which he founded has been celebrating the centenary of John Wesley, how many of his followers have been made aware that he was the author of a work on electricity? This curious *brochure* was published in 1759, under the title of "The Desideratum; or, Electricity made Plain and Useful by a Lover of Mankind and of Common Sense." The titles of the sections are decidedly suggestive: "Electricity the Soul of the Universe;" "The Cat in the Oven, curious Electrical Experiment;" "A Person with Small-pox cannot be Electrified;" "Electricity the greatest of all Remedies." The reverend author goes in for a serious argument to demonstrate that it is "just as *innocent* to keep our rooms tight from lightning, as from wind and water." One of the entries is as follows: "Exp. 32. A Person standing on the Ground cannot easily kiss an electrified Person standing on the Rosin." About half the volume is taken up with narratives of cures supposed to have been wrought by electrifying, the diseases being of the most varied kind, from fistula to epilepsy. Even the cure of moral diseases is attributed to electricity. "*Felons* are speedily cured by drawing Sparks. If any disorder be superficial this Operation suffices: But if it lie deeper, then the giving of Shocks is found to be more effectual." The good old divine had probably little idea what mischief his well-meaning recommendations of electricity might work. Happily, in science more weight is attached to proved facts than to the authority of a great name. And Wesley's attempt to intervene in science was less successful than his intervention in ecclesiastical organization.—*The Electrician.*

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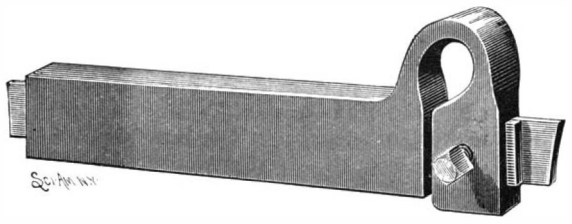
A TOOL HOLDER FOR LATHES, PLANERS, ETC.

The improved tool holder shown in the illustration, for which a patent has been granted to Mr. L. B. Nielsen, is designed to hold the tool in an efficient manner, and yet yield when the tool meets an unusual obstruction, liable to break off the point of the tool. The holder has a rectangular shank, with a horizontal opening on its under side, through which the tool extends, and at one end of the shank is an inverted U shaped bow, the free end of which extends slightly below the body of the shank, this portion being thickened, as shown in the engraving. The free end is held slightly away from the end of the shank, to allow for the necessary spring when the tool meets an unlooked-for obstruction, the device being made of spring metal to permit of such movement. In the thickened end of the holder is an opening aligning with the opening in



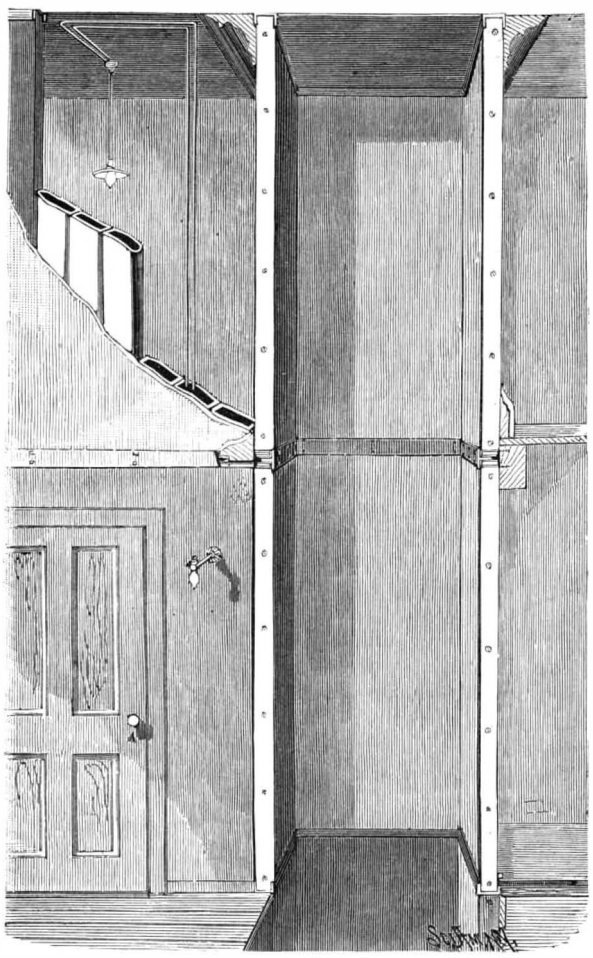
NIELSEN'S TOOL HOLDER.

the shank, to receive the tool, which is held in place by a binding screw in one side, a suitable clamping piece being interposed between the end of the screw and the tool. When the holder is used for lathe work the thickened portion of the bow end may be also widened on its opposite side, thus giving greater bearing surface for the lower portion of the tool.

Further information touching this invention may be obtained by addressing the patentee, Lakeside Hotel, Lakeside Avenue, Orange, N. J.

FIREPROOF PARTITION WALLS.

The illustration represents a fireproof partition construction especially adapted for elevator and light shafts, being light, durable, and readily placed in position, and affording when in place convenient passageways for electric wires, speaking tubes, water pipes, etc., or for use as heating or ventilating flues. It has been patented by Mr. Charles W. White, builder, of No. 53 East Eleventh Street, New York City, and has met with the approval of the city building department, being also recommended by the Board of Underwriters. This partition wall is made of a series of connected slabs, each slab being composed of side bars connected by cross bars, preferably of iron, to form a light, well braced frame, well adapted to hold a fireproof filling or



WHITE'S FIREPROOF PARTITION.

body, which is placed in the frame in a plastic state. Centrally in the slabs are placed flat tubes, arranged in alignment to form continuous passages, the tubes being constructed of a highly refractory material and made impervious to water. In putting up a wall, a suitable track is fixed to the ceiling, and one on the floor, when the slabs are placed in position and joined together by bolts passed through the side bars, such a partition taking up but very little space. A perforated sheet of metal may, if desired, be placed on the slab, by bending the ends over the side bars, to afford a hold for the last coat of plaster, or the slabs may be faced with any desired ornamentation, so that when up it will not be necessary to give the wall a finishing coat. The sections of this partition are entirely made and dried outside of the building where they are to be placed, thereby avoiding the appearance of cracks in the work afterward.

An English Trade Mark Decision—Pinto vs. Badman.

This was a case tried in the Court of Appeal in connection with a trade mark action tried by Mr. Justice Day and a special jury in the Court of Queen's Bench in January last. In the court below the jury found a verdict upon two issues to the effect that the trade mark used by the defendant was a colorable imitation of the plaintiff's trade mark, and that the defendant had been guilty of fraudulently passing off as and for the goods of the plaintiff, goods which were not his. From that judgment the defendant appealed upon the ground, among others, that the plaintiff's trade mark had been improperly registered.

For the appellant it was argued that the plaintiff had no registrable interest in the trade mark, because he had acquired from his predecessors in title only a right to use the mark, and not the goodwill, of the business in connection with which the mark had been used. In proof of this reference was made to the deeds by means of which the plaintiff had deduced his title to the mark, and it was contended that these deeds amounted to an assignment of the mark in gross—that is to say, by itself, and not as a mere part of the goodwill of a business which was being sold. The deeds being drawn up in Spanish, and executed in Mexico, some difficulty was experienced by the court in coming to any conclusion as to their effect, but eventually it was held that they conveyed, as has been said, no goodwill or business, but only an independent right to the use of the mark. This being so, it was held that the registration was bad, and that the plaintiff therefore was not entitled to maintain the action in which he had recovered judgment. The judgment was accordingly reversed and entered for the defendant, but without costs.

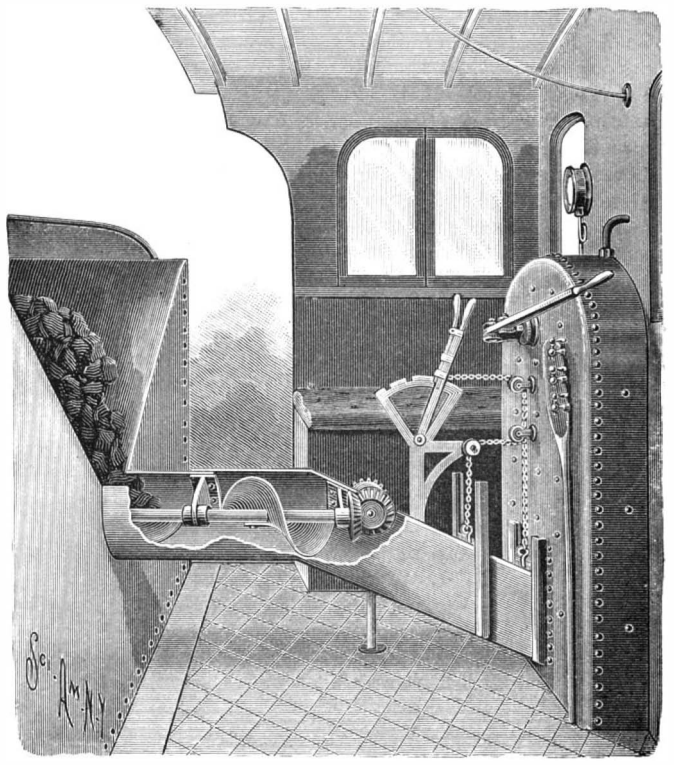
The principle embodied in this decision is of the very greatest importance in trade mark law, and should be constantly borne in mind in any transactions in which the transfer of rights to such marks is involved. It is in the public interest, and not in the interest of the parties, that the rule has been laid down that a trade mark shall not pass without the trade to which it is attached. The reason of this is plain enough. It is no doubt greatly to the interest of the owner of a trade mark that the public should recognize the brand as designating his goods, but it is so because and only because it is to the interest of the purchaser to be able by this means to identify the article which he is purchasing. Now, if the owner of a trade mark were at liberty to sell his mark while he retained his trade, it is clear that the public might be deceived by having the whole meaning of a known mark surreptitiously altered. This might not matter to the contracting parties, but it would amount to a fraud upon the public, and for the repression of such fraud the rule has been introduced. The present was a very striking case of its application. There was no evidence that the assignment was not perfectly valid. According to the law of Mexico—the country in which it had been executed—it was admitted in the fullest possible manner that the person originally entitled to the mark who had assigned it to the plaintiff had parted with his own rights, but nevertheless, as the title which the plaintiff set up affected the rights of the British public, it was held that the transaction and the registration founded upon it could not be supported in a British court of law. There seems no room for doubt that the judgment correctly expresses the law, and it must be taken therefore that in no circumstances will the courts be likely hereafter to depart from the strict principle which has been so emphatically asserted in the present case.—*Industries.*

"IF, through a leak in the gas main, a tree should be killed, is the company legally liable for the loss? And if not, is it generally the custom to pay damages for the same?"

The answer to this question by a member of the N. E. gas managers was that the company was certainly liable; but we never make it a question of law. As soon as we have a report of injury by reason of a gas leak, we tell the party we are very sorry, and give a nurseryman an order to replace the tree.

A MECHANICAL STOKER.

The construction herewith illustrated, especially adapted for locomotives, is designed to obviate the work of charging the firebox with fuel and prevent the escape of heat. It has been patented by Mr. John B. Ward, of No. 16 Eighth Street, N., Minneapolis, Minn. The inner sides of the tender or coal receptacle are inclined, and centrally in the bottom is a channel, into which extends the shaft of a feed screw, coupled at its outer end with another similar shaft. The latter shaft has a bevel gear wheel meshing into a similar wheel on a transverse shaft in the cab, connected with a motor or adapted to be operated in the most convenient manner, whereby the coal will be fed by a suitable inclined chute into the fire box. In this chute are two gates, the lower gate closing the opening into the fire box, while the upper one is a short distance back, preventing the fuel from passing down against the fire box



WARD'S MECHANICAL LOCOMOTIVE STOKER.

gate. The gates are simultaneously elevated by means of connected chains passing up over pulleys, one chain being connected to a hand lever fulcrumed on a bracket, and adapted to be locked on a segment by means of a pawl. The feed screw is operated to accumulate fuel in the inclined chute, against the upper gate, and when the gates are raised, the fuel is discharged by gravity inside the fire box. The wings of the feed screws are made in half-turn sections, and are held adjustably by screws or other means upon their shafts, so that they may be moved closer together or farther apart, according to the size of the fuel employed.

New Atlantic Steamer.

The Havel, a screw steamer of 9,000 tons register and 14,000 h. p., the latest addition to the fleet of the Norddeutcher Lloyd, has been placed by her owners on the Bremen, Southampton and New York line. She has been built by the Vulcan Company, at Stettin, on the one-screw system. The engines are triple-expansion, the high-pressure cylinder 38 in. diameter, the intermediate pressure 75, and the low pressure 100, each of which is adapted for a stroke of 6 ft. Steam is supplied from ten boilers, of which six are double-ended and four single-ended. Each boiler is 15½ ft. in diameter; the length of the double-ended 18 ft. 8 in., and of the single-ended 10 ft. 4 in. The boilers are constructed entirely of steel, and are adapted for a working pressure of 11 atmospheres. The propeller has four blades of manganese bronze, the diameter of the screw being 21 ft. 7 in. and its pitch 31 ft. 4 in. The Havel is rigged with three pole masts of steel, without yards. She is 485 ft. long, 52 ft. beam, and 38 ft. deep, moulded, and has accommodation for 244 passengers in the first saloon, 122 in the second, 460 third-class passengers, and officers and crew to the number of 240. The saloon, a very spacious apartment, is fitted up in an elegant and elaborate manner, and the cabin accommodation is most comfortable. The Norddeutcher Lloyd now own a sufficient number of first-class steamers for a tri-weekly express service between Bremen, Southampton, and New York; and the directors have decided to dispatch steamers to New York on Wednesdays, Thursdays, and Sundays from Southampton, after the 7th of March, during the season.

ONLY 2,500,000 of the 11,000,000 square miles of Africa remain in the hands of native rulers. France has 2,300,247 square miles. England 1,900,445. Germany 1,035,720, Congo Free State 1,000,000. Portugal 774,993, Italy 360,000, Spain 210,000. While the share of France is largest, England's is most valuable.

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Correspondence.

Leap Year.

To the Editor of the Scientific American:

The Gregorian calendar, as it is, loses one day in 3,600 years. The rule for leap year is, add one day to February every 4 years, unless it be divisible by 400. It would be much better to add one day to February every 5 years, two days ever 25 years, and three days every 450 years. Thus every 5th year, February would have 29 days, and the year 366 days; every 25th year, February would have 30 days, and the year 367 days; every 450th year, February would have 31 days, and the year 368 days. By this plan every year ending in 0 or 5 is a leap year, and could be known at a glance. The error in this amounts to one day in 50,000 years. E. A. F.

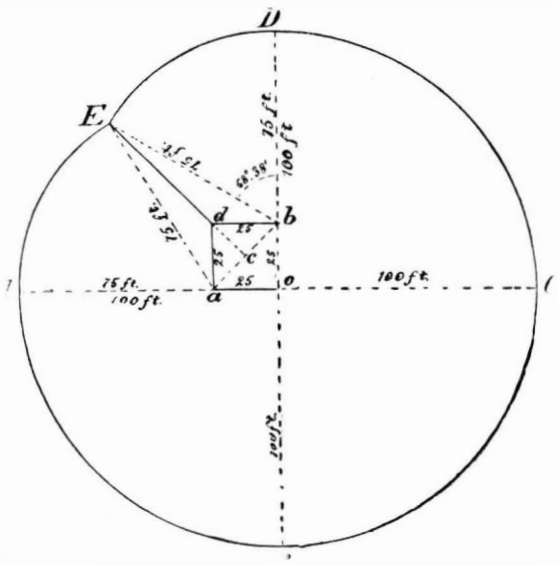
West Salem, Ill.

The Horse and Barn Problem.

To the Editor of the Scientific American:

Your reply (No. 2892) in the Notes and Queries column of March 21 issue is, I think, erroneous. It assumes that the tethered horse can feed only in one direction. But by the terms of the problem he is not so restricted; he is free to graze on all sides, as far as his rope will let him. By a reference to the accompanying figure, it is clear that the horse, tethered at O, can feed through *three quadrants of* 100 *ft. radius*, viz., quadrants O A B, O B C, and O C D.

Feeding from A toward E, and from D toward E, the radius will be 75 ft. Here the horse has two overlapping quadrants of 75 ft. radius each to feed over. The correct solution, therefore, seems to be this: The feeding ground comprises *three quadrants of* 100 *ft. radius*, *two sectors* E *a* A *and* D *b* E *of* 75 *ft. radius* and 58° 38'



angle, and the *figure* E *a d b*, which is equal to the triangle E *a b minus* the triangle *a d b*. In these triangles the sides are known.

Area of the three quadrants of 100 ft. radius. ...	23561·925	sq. ft.
" " two sectors of 75 ft. radius.....	5756·188	" "
" of triangle E *a b* 1288·465		
Minus triangle *a d b* 312·5 (or figure E *a d b*)....	975·965	" "
Total....	30294·078	" "

REV. CLARENCE E. WOODMAN, Ph.D.

New York, N. Y.

[This is one of many communications we have received on the subject. The assumption underlying the solution given in query 2892 was that the horse started with his rope at its full stretch and fed around in one direction until it was exhausted or completely wound up. If the statement is taken without such assumption, then the answer is easily obtained. The above communication gives a simple method in outline. The error in the solution of Query 2892 was in the misconception of the statement. The above letter we commend to those interested as an exponent of the true method of treatment.—ED.]

Premonitions, Coincidences, and Superstitions.*

Nobody can fully explain the states of his own inner consciousness, or tell the reasons why, when in apparent good health, the atmosphere is luminous with transcendental glory, and anon is shadowed by dimly comprehended specters. Many individuals have strangely recurrent coincidences or presentiments, which, considered abstractly, are—whether forewarnings of good or of evil—so frequently fulfilled that it is difficult to assume them to be casualties only. Science, however, is dumb in explaining the *rationale* of such phenomena. There are times and seasons when the entire firmament is rose colored, and then, without any apparent reason, the heavens are overcast, and we each learn this lesson anew, that the cause of our sorrows, discomforts, and misfortunes lies deep in the nature of things. Perhaps this is one reason why we pay attention to mystical forecasts, and there seems to spring into existence "the prophetic soul of the wide world dreaming on things to come."

It is customary to say it is lucky to do a certain act at a certain time; it is unlucky to do certain things, or to leave undone this, that, or the other thing. If logically traced to the source from which such observations sprang, it is found all such superstitions are based on the law of coincidences. Take an individual in a slightly morbid or reflective state, and the dark side of human affairs thrusts itself upon his notice—the tyranny of the strong toward the weak, the cruelty abounding in nature, the transitoriness of all human affairs; and let a number of coincidences occur bearing upon some one of these subjects of thought, and a superstition is founded, which may be transmitted and become perpetuated from generation to generation.

Many persons reject and ridicule the common superstitions found to exist quite as much among the intelligent as in the every-day life of the common people. The individual who sits at the table, making the company thirteen, will laugh and jest at the timorous anxiety of his hostess, who had—previous to his unexpected arrival—been to considerable trouble to avoid such a casualty, but will feel uncanny if he spill the contents of the salt jar accidentally, and will hasten to burn some immediately, to ward off any evil effects which might otherwise occur in his business relations; or he will pass some anxious moments if he observes the new moon over his left shoulder, instead of his right, nor will he undertake anything important on Friday. Many persons who pride themselves on being proof against the folly of superstition yet feel uneasy if they do not observe the rules governing this bit of unreason in other people. Scientific scholars who have reasoned from effect to cause, who have accepted the fact that matter and force are indestructible—such minds may be observed to be influenced by the good will of Pussy, she having since the days of the Egyptians traditionally brought good luck to the house of her choosing; while the breaking of a mirror is supposed to bring misfortune seven years long to the unlucky possessor.

The negro and Indian races are very superstitious; their comings and goings, their up-risings and down-sittings, are governed by a series of invisible laws that would render life one long nightmare to a sensitive and trained intellectual race. Among the negroes, after death the soul of the dead is supposed to be hovering around, and many devices are resorted to to appease the ghost, and to appease the ill will that may have been awakened by lack of reverence to the living and unseen portion of the departed in the handling of the dead. Still, if any person has a blemish—is lame, sick, bruised, or sore—he will not touch the dead, as his ailment is thereby rendered incurable; indeed, any one who assists in caring for the body of a deceased person will be sure to carry away something belonging to the deceased, to insure him against visits from the "duppy," or ghost. The flight of certain birds over the house and back again indicates a sudden death in the family. The beautiful turtle dove, from the plantiveness of its note, is looked upon as a token of evil omen, foretelling serious misfortune or death if it lights upon the house. No "duppy" ever visits the living with good intent, but always to work harm. There are certain plants and trees given exclusively to be the habitation of the ghosts, and no negro will pass or handle one of the bewitched specimens of vegetation. The practice of dancing about the corpse is out of fear of vengeance to be now paid to any person from the ghost, as no one can make the circle who did harm (*i. e.*, administered poison) to the deceased, as he would, if guilty, surely fall into convulsions and die miserably. Occult methods of obtaining poison from plants and deadly snakes obtain, and may be administered so as to defy discovery; hence this disgusting practice of the dance of the death circle. Remedies are prescribed of so simple a nature that if no good is done, no harm can follow. Tying knots in a bit of woolen yarn, a knot for each wart, walking backward, muttering "de spiruts done settle down," with the knotted string held in the hand till near the fire, then rubbing the knots until slowly consumed, will cure the warts.

A similar formula over a bit of wet paper plastered on the chest will cure hiccoughs. The hand of a dead person slowly rubbed over sore eyes, with the same formula, only "de spiruts done walk ober" added, is a sure cure. Nails can be conjured from the joints of rheumatic patients by repeating a charm, and whooping cough cured by placing the child under a charm. The faculty for seeing "duppies" is given to those persons who at birth had a caul over the face. This membrane is treasured by the family with much care, as the possession brings good fortune and the power to foretell coming events.

The Indians are quite as superstitious as the negroes, but they are a much more reserved and unsocial race, so it is much more difficult to ascertain the legends and explanations for their curious rites. An Indian will turn from his course and vary to the right or to the left without any explainable reason, apparently; he has come to a marching column of migrating ants, and has turned to one side to avoid crossing the route traveled by them. The worst of disasters would be drawn down on the unlucky mortal who failed to observe this rule. Birds are credited with having supernatural powers. The rain-crake, with its unearthly and melancholy cry, is a very prophet of evil. They are popularly thought to be the spirits of the departed come back to mourn and avenge injuries done to them in life. Eating together constitutes a sort of kinship, and he who breaks the bond will be detected by the ticking of a certain beetle. The neighing of a horse when you meet a stranger betokens trouble. To have a crow cross your path, flying over head, is a sure forerunner of sickness and death.

Most of these superstitions can be read by the law of coincidence. Thirteen persons at table coincides with the unlucky number at the memorable supper in which Judas betrayed the sinless one and went to his own death. Spilling salt is coincident with the evils that accrued to the salt-tax gatherers during the French revolution. The strangest part of these coincidences—which, if observed until sufficient data are collected, may be termed analogies—is that there seems to be a certain unexplained law of the mind in its groping that often leads to new facts and discoveries.

In his *Budget of Paradoxes*, De Morgan relates the following story or theory: "The late Baron Zach received a letter from Pons, a successful finder of comets, complaining that for a certain period he had found no comets, though he had searched diligently. Zach, a man of much sly humor, told him that no spots had been seen on the sun for the same length of time—which was true—and assured him that when the spots came back, the comets would come with them. Some time after, he got a letter from Pons, who informed him with great satisfaction that he was quite right; that very large spots had appeared on the sun, and that he had found a comet soon after."

To make the story complete there should now be found a connection between the comets and the sun's spots. The curious thing is that just this paradox was maintained before the Royal Astronomical Society by Professor Ashe before De Morgan's book came out.

I have known one who has the capacity for invention to make statements about the necessary mechanical appliances needed to produce certain ends, that sounded wildly improbable; and yet the most improbable are now facts. The quadruplex system for use in telegraphy was dreamed of when to relate the dream was a tale of wild improbability. This has occurred many times, and allows a perfectly natural interpretation—as some other mind traversed the same road and solved his dream into practicability by creating the necessary steel and iron image to express an embodiment of his thought.

Again, there have been well attested instances in which mind acts on mind independently of distances. It would be hard to prove that when we think—and that in spite of a determination to think of other things—of some absent person that he is thinking of us. But if in a number of instances a number of persons were to record such experiences and compare results, the law of coincidence would have great weight in determining the truth or fallacy of such a law. In trying to grasp an abstruse subject like the relation between mind and matter, there must, from the nature of the working medium, ever be many opportunities for fallacious reasoning—as it is impossible to speak of mind as affiliated with the body, with a brain and the nerve currents, without localizing the mind, and proving its habitat and absolute identity. Mental and bodily states are never identical, but contrasted. There is no means of effecting a compromise between them, and in trying to express thought about mind it is not easy to say anything without localizing it. There is the old difficulty to be met: Is mind found in every organ, or all in the whole?

Leaving all this, however, and allowing the statement that mind is, indeed, as a phenomenon different from physical forces, but correlates more or less directly in strict proportion with these, mind must be admitted into the circle of correlated force. Of course, it is quite impossible to reduce the quantity or quality of mind force to any method of mathematical precision. Vitality, energy, mental qualifications, health, courage, love, irascibility, may have a standard in our own mind with regard to an individual, but we cannot reduce such qualities with mathematical precision, and cannot communicate to others with exactness our own idea. When taking into consideration the physical facts underlying the mental facts, it may show that widespread concomitant action of the nerve currents and the agitation of the brain that may account for many of the unexplained incidents, divinations, witchcrafts, and similar phenomena as a result of that tumultuous conflict, and exercise of energy in reconciling the union of the material to the immaterial, even among the inferior races of mankind.

ONE of the latest additions to the British navy is the Blenheim, a protected cruiser of 9,000 tons displacement. Of this weight 4,000 tons are used for the protecting plates, armament, equipment, and coal. She is 375 ft. long, 65 ft. beam, 20,000 h. p., and 22 knots speed. She is considered to be the largest, fastest, and most powerful war ship in the world.

* By M. J. Gorton in *Popular Science News.*

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THE PATENT CENTENNIAL.

The Congress of Inventors and Manufacturers of Inventions, to be held in Washington on the 8th, 9th, and 10th of this month, is certain to be a most enthusiastic and numerously attended assemblage, in every way worthy of such an occasion as the celebration of the beginning of the second century of the American patent system. We have been living in a period which has been distinguished by many noble centennial celebrations, from the great world's exposition in 1876, to celebrate the one hundredth anniversary of the Declaration of Independence, down to the great assembling in New York to mark the corresponding anniversary of the adoption of the Constitution, but it is believed that none of these events have been more memorable, or have been more clearly significant of American progress, than will be the celebration to be held in Washington next week. There will be no disinterested onlookers, but in the large attendance, drawn from the remotest quarters of the country as well as from near-by places, and from workers in every industry and every department of science, there will be a keen appreciation of the dignity and the importance of the occasion.

Besides engaging the largest public hall in Washington for the regular meetings, provision has been made for overflow meetings, and it is expected that a far greater variety of subjects will be presented illustrative of the progress of American invention than the projectors had at first anticipated. The programme arranged by the literature committee has been most favorably regarded by all friends of the movement, and the responses from inventors, specialists, and prominent men in different sections indicate that the literary entertainment provided will be a most attractive one.

So far as at present arranged for, addresses upon the following subjects are promised at the public meetings:

Edward Atkinson, Ph.D., LL.D., of Massachusetts.—Invention in its Effects upon Household Economy.

Dr. John S. Billings, Curator, U. S. Army Medical Museum.—American Invention and Discoveries in Medicine, Surgery, and Practical Sanitation.

Hon. Samuel Blatchford, Justice of the Supreme Court of the United States.—A Century of Patent Law.

Cyrus F. Brackett, M.D., LL.D., of New Jersey, Henry Professor of Physics, College of New Jersey, Princeton.—The Effect of Invention upon the Progress of Electrical Science.

Hon. Benjamin Butterworth, of Ohio, U. S. House of Representatives.—The Effect of our Patent System on the Material Development of the United States.

Octave Chanute, of Illinois, President of the American Society of Civil Engineers.—The Effect of Invention upon the Railroad and other means of Intercommunication.

Professor F. W. Clarke, S.B., of Ohio, Chief Chemist, U. S. Geological Survey.—The Relations of Abstract Scientific Research to Practical Invention, with Special Reference to Chemistry and Physics.

Hon. John W. Daniel, of Virginia, U. S. Senator.—The New South as an Outgrowth of Invention and the American Patent Law.

Major Clarence E. Dutton, Ordnance Department, U. S. A.—The Influence of Invention upon the Implements and Munitions of Modern Warfare.

Thomay Gray, C.E., B.Sc., F.R.S.E., of Indiana, Professor of Dynamic Engineering, Rose Polytechnic Institute, Terre Haute.—The Inventors of the Telegraph and Telephone.

Professor Otis T. Mason, Ph.D., of Virginia, Curator, U. S. National Museum.—The Birth of Invention.

Hon. Charles Eliot Mitchell, of Connecticut, Commissioner of Patents.—The Birth and Growth of the American Patent System.

Hon. O. H. Platt, LL.D., of Connecticut, U. S. Senator.—Invention and Advancement.

Col. F. A. Seely, of Pennsylvania, Principal Examiner, U. S. Patent Office.—International Protection of Industrial Property.

Hon. A. R. Spofford, LL.D., Librarian, U. S. Congress.—The Copyright System of the United States: Its Origin and its Growth.

Hon. Robert S. Taylor, of Indiana.—The Epoch-making Inventions of America.

Robert H. Thurston, A.M., LL D., Doc. Eng., of New York, Director and Professor of Mechanical Engineering, Sibley College, Cornell University.—The Inventors of the Steam Engine.

William P. Trowbridge, Ph.D., LL.D., of New York, Professor of Engineering, School of Mines, Columbia College.—The Effect of Technological Schools upon the Progress of Invention.

Hon. Edwin Willits, of Michigan, Assistant Secretary of Agriculture.—The Relation of Invention to Agriculture.

Hon. Carroll D. Wright, M.A., of Washington, Commissioner of Labor.—The Relation of Invention to Labor.

The names of the originators and principal promoters of this centennial celebration of our patent system are given herewith:

Central Committee.—John W. Babson, Chief of Issue and *Gazette* Division, United States Patent Office. Robert W. Fenwick. Brainard H. Warner, President, Columbia National Bank. Professor Otis T. Mason, Curator, United States National Museum. Myron M. Parker, President, Washington Board of Trade. Hon. John Lynch, President, Potomac Terra Cotta Company. Marvin C. Stone, Manufacturer of Novelties. J. Elfreth Watkins, Secretary, Curator, United States National Museum.

Executive Committee.—Hon. John Lynch, Chairman. J. Elfreth Watkins, Secretary. John W. Babson, Marvin C. Stone, George C. Maynard.

In the accompanying illustrations we present portraits of a limited number of the imposing array of lawyers, judges, administrators, legislators, and patent specialists taking part in this centennial celebration, our space being all too small to attempt anything like so full a record as we should like to give.

In such a list we necessarily include the Hon. Samuel Blatchford, a Justice of the United States Supreme Court, who is to deliver an address on "A Century of Patent Law." His decisions in memorable patent cases in the United States Circuit Court, and in other important causes, having during many years always commanded the close attention of all members of the bar, and his promotion to the Supreme Court was generally looked upon as a thoroughly well earned advancement.

The Hon. John W. Noble, Secretary of the Interior in President Harrison's Cabinet, and thus the direct official head of all our patent business at present, has taken an active part in assisting to make the celebration a thoroughly imposing and representative one. He will personally preside at some of the meetings, and, with other prominent officials, hold receptions especially for inventors and manufacturers and their representatives.

The Commissioner of Patents, Hon. Charles E. Mitchell, of Connecticut, around whose office is centered the great interest of the occasion, is a man of the highest ability, wide influence and exalted character. He is distinguished by his clear judgment, and had previously been a most successful patent lawyer. He has proved himself well qualified for the arduous duties of his office. He is a graduate of Brown University, about fifty-five years of age.

The Hon. Benjamin Butterworth, of Ohio, who is to deliver an address on "The Effect of Our Patent System on the Material Development of the United States," has been so prominently before the public for many years, Commissioner of Patents and as a member of Congress, and a public speaker of great power and influence, that his participation in the celebration will be an important factor. He has been the chairman of the House Committee on Patents, and through many years has worked with energy and discrimination for the protection of the interests of inventors.

Dr. R. H. Thurston, director of Sibley College, Cornell University, who is to speak on "The Inventors of the Steam Engine," has a subject to the elucidation of which he brings a great store of knowledge. His treatment of the matter will be sure to be most instructive and interesting.

The Hon. Carroll D. Wright, Commissioner of Labor, who is to speak on the "Relation of Labor to Invention," has made a practical study of all phases of the labor question from an economic standpoint, and speaks on such questions with an authority everywhere acknowledged. He first made a science of this department of investigation as the organizer of the Massachusetts Bureau of Labor Statistics, and has brought to his present wider field a method and system heretofore unknown.

Dr. John S. Billings, who is to speak on inventions and discoveries in medicine, surgery and practical sanitation, is a United States army surgeon, in charge of the Army Medical Museum. He has an international reputation as a sanitarian, and his recent work on medical bibliography is to-day the leading authority on the subject.

Hon. John W. Daniel, U. S. Senator from Virginia, very appropriately speaks on the New South as an outgrowth of invention and the American patent law. He was born in Lynchburg, Va., in 1842, served in the confederate service during the war, rising from the ranks to a colonelcy, and since the war has become distinguished as a lawyer and orator.

Dr. Cyrus F. Brackett, Henry Professor of Physics in Princeton College, who is to speak on invention as related to the progress of electrical science, is a widely known authority in this field, and, in conjunction with Prof. Anthony, has published a recent book on physics with which many of our readers are probably familiar.

Thomas Gray, of Indiana, who is to speak on telegraph and telephone inventions, is a civil engineer and professor of dynamic engineering in an institute at Terre Haute.

The Assistant Secretary of Agriculture, Hon. Edwin Willits, of Michigan, most appropriately has the subject of the relation of invention to agriculture.

Mr. Ainsworth R. Spofford, of the Advisory Committee, is the efficient and accomplished Librarian of Congress, and is from New Hampshire, where he was born in 1825. He became the principal Librarian in 1865, having previously served a term as assistant. Mr. Spofford has seen the library grow from about seventy-five thousand to nearly half a million volumes, and he has had great influence with successive Congresses in securing legislative action for a proper building for the rapidly accumulating store of books, adequate provision for which has only recently been made, while the plans are but tardily being carried out. He is recognized as a bibliographer of great attainments, and peculiarly fitted for his responsible position.

Mr. J. W. Babson, of the Patent Office, is from Maine, and entered the Interior Department in 1866 as Chief of the Finance Division and Deputy Commissioner of Pensions. He was assigned to the charge of the *Official Gazette* in 1878, and in 1880 was appointed chief of the Issue and Gazette Division, which position he now holds. Of the 54 vols. of the *Official Gazette*, 41 have been published under his direction, and of the 448,000 patents granted by the Patent Office, more than half have been prepared and issued under his charge.

Llewellyn Deane, of Washington, D. C., a member of the Literature Committee, is a native of Maine, and descended from Pilgrim stock. He is a graduate of Bowdoin College, and a lawyer by profession, and makes the patent business a specialty. He was a principal examiner in the U. S. Patent Office for several years. In earlier years he had considerable legislative experience in Maine. He is actively connected with local scientific societies.

John Lynch, the chairman of the Executive Committee, is a native of Portland, Me., and is engaged in commercial business and interested in manufacturing and railroad enterprises. He was elected in 1864 from the first Maine district (now represented by Speaker Reed) to the Thirty-ninth Congress, and re-elected to the four succeeding Congresses, retiring in 1873. As chairman of committee on "The Causes of the Decline of American Shipping," he submitted a report with bills for the revival of American navigation interests which attracted attention not only in this country but in Europe. He was also the author of bills passed January 27, 1873, extending the life-saving service (then confined to the coasts of Massachusetts and New Jersey) along the whole Atlantic, Pacific, and lake coasts of the United States, and connecting same by telegraph with signal service and lighthouses. This is the foundation of the present life-saving service of the United States. Owning a large tract of land near Washington, upon which are beds of terra cotta clay, he established the Potomac Terra Cotta Works, and in connection with this manufacture has made several inventions which have been patented in this country and Europe.

Marvin C. Stone, of the Central Committee, was graduated from Oberlin College, Ohio, in 1872, and began life as a Washington correspondent, representing the New Orleans *Picayune*, the Cleveland *Leader*, and various other journals. Mr. Stone drifted into the manufacturing business, and to-day employs over four hundred operatives, and paying out considerably over one hundred thousand dollars annually in wages alone. He confines himself to the manufacture of novelties of his own invention. He has taken out a large number of patents on the various articles which he manufactures, but he bases his claim as an inventor especially upon the fountain pen with capillary feed.

Robert W. Fenwick, a patent attorney and a member of the Central Committee, was born in Washington in 1832. His uncle, Benjamin Fenwick, was one of the three who composed the Patent Office corps in 1812–16. Mr. Fenwick studied architecture, civil engineering, and mechanical drawing, and was for seven years employed in the patent department of the SCIENTIFIC AMERICAN at New York, being afterward similarly employed in charge of our branch office in Washington. Since 1861 Mr. Fenwick has followed business as a patent attorney in Washington. He was called to preside as chairman of the meeting at which it was determined that a celebration of the second century of our patent system should be celebrated in 1891. He was authorized by this meeting to appoint a committee to arrange the programme for the celebration.

George Brown Goode, of the Advisory Committee, was born in New Albany, Ind., 13th February, 1851. He was graduated at Wesleyan University, in 1870, pursued a short postgraduate course at Cambridge and in 1871 took charge of the organization of the college museum at Middletown. In 1873 received an appointment on the staff of the Smithsonian Institution, and on the organization of the National Museum became its assistant director, and in 1887 assistant secretary of the Smithsonian Institution. The natural history division of the U. S. government at the Philadelphia exhibition in 1876 was under his supervision. He was U. S. commissioner in charge of the Amercan sections at International Fisheries exhibitions in Berlin in 1880 and in London in 1883, and was also member of the goverment executive board for the New Orleans, Cincinnati, and Louisville expositions in 1884, and of the board of management and control of the World's Columbian exposition of 1893. From 1872 until 1887 he was intimately associated, as a volunteer, with the work of the U. S. Fish Commission. In 1877 he was employed by

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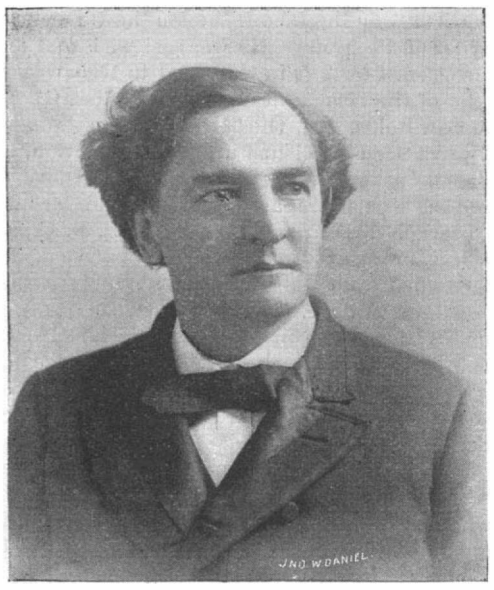
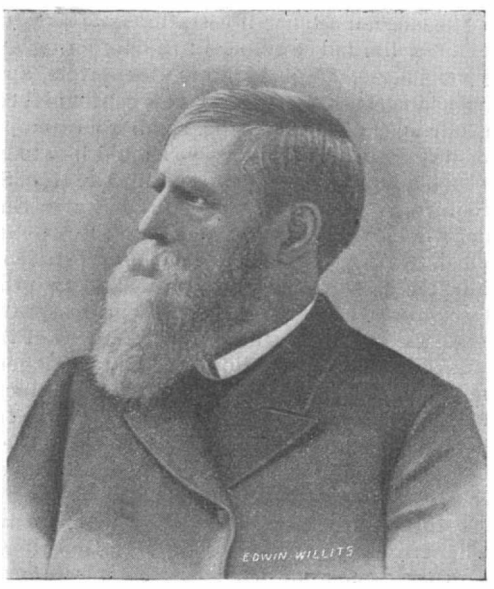
the Department of State as statistical expert in connection with the Halifax fisheries commission, and in 1879–80 was in charge of the fisheries division of the tenth census, and in 1887 was appointed U. S. Commissioner of Fisheries, resigning the position early in 1888. He has traveled through Europe for the purpose of studying the methods of administration of the public museums, and has made extensive natural history explorations in the Bermudas and Florida. His published papers are numerous, and include, besides several books, about 200 minor titles on topics in ichthyology, museum administration, and fishery economy and American history.

Franklin A. Seely, of Pennsylvania, of the Advisory Committee, was born in 1834, graduated at Yale College in 1855, served in the Federal army during war of the rebellion as assistant quartermaster of volunteers, and was discharged in 1867 with the brevet rank of lieut. colonel. He was appointed assistant examiner in the Patent Office in November, 1875, and chief clerk of that office in April, 1877. He held the latter office until June, 1880, when he was appointed principal examiner, and put in charge of the classes of invention which had heretofore formed the philosophical division, except electricity, which was made to constitute a separate division. To the new division was added trade marks, which had heretofore constituted a division by itself. Colonel Seely's division has remained substantially the same ever since. When the United States became a member of the International Union for the Protection of Industrial Property, the work of reviewing the Convention of Paris of 1883 was assigned to Examiner Seely, and his interpretations of that instrument have been accepted here and abroad as correct. Since then he has had charge in the Patent Office of all questions arising under the convention, and growing out of international relations, and a year ago was a delegate from the United States to the International Conference at Madrid. Colonel Seely was for many years Secretary of the Anthropological Society of Washington, and is at present one of the editing committee of its quarterly publication, the *American Anthropologist*. He has given much time to the study of the philosophy of invention, on which he has published several papers.

George C. Maynard, of the Advisory Committee, is a native of Ann Arbor, Michigan. He was educated in the public schools of that State and studied physics with the late Professor James C. Watson, Director of the Michigan Observatory. Commenced telegraphing at the age of fifteen and has been engaged in electrical work ever since. During the war he entered the Military Telegraph Corps, and after the close of the war was chief operator in the Western Union Telegraph office for several years. He organized the tele graph system of the weather bureau, and, after two years' service in the signal office, resigned to engage in

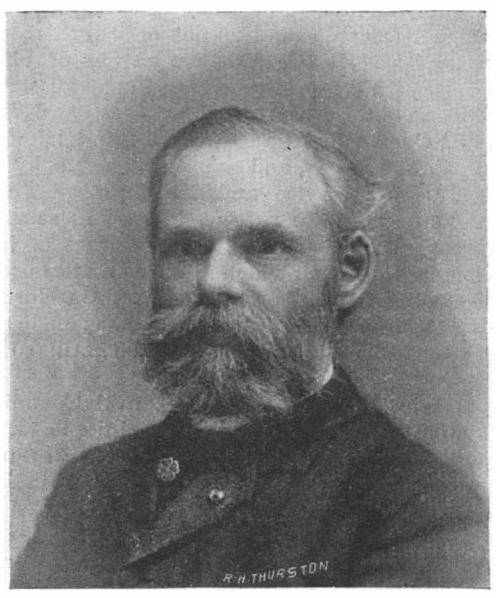


HON. JOHN W. DANIEL, OF VIRGINIA, U. S. SENATOR.



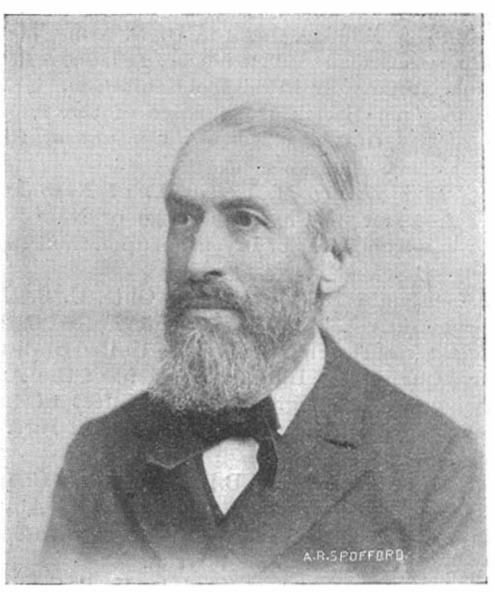
HON. EDWIN WILLITS ASSISTANT SECRETARY OF AGRICULTURE.

HON. SAMUEL BLATCHFORD, JUSTICE U. S. SUPREME COURT.

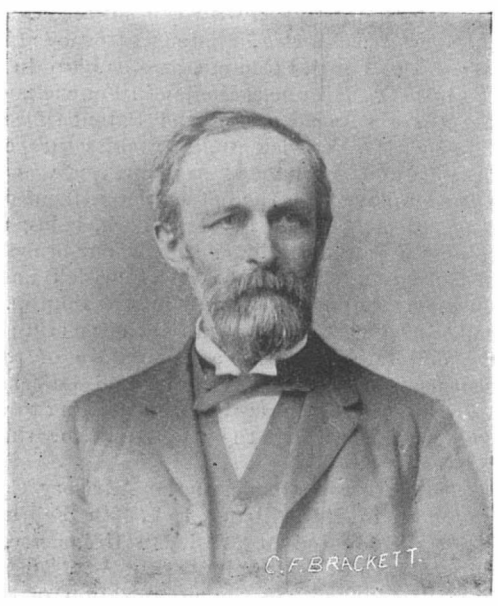


PROF. R. H. THURSTON DIRECTOR SIBLEY COLLEGE, CORNELL UNIVERSITY.

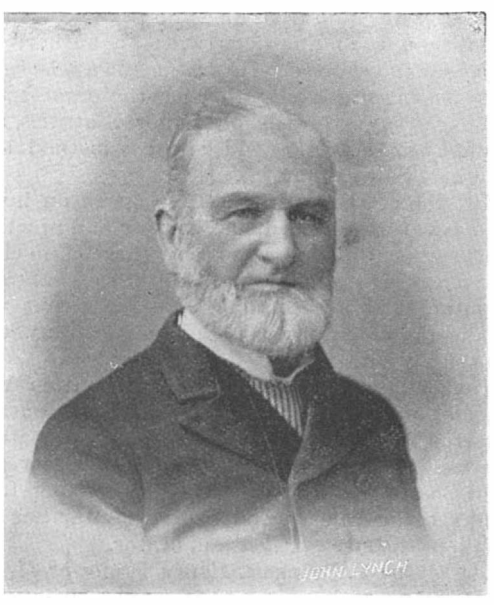
THOMAS GRAY PROFESSOR ROSE POLYTECHNIC INSTITUTE, TERRE HAUTE.



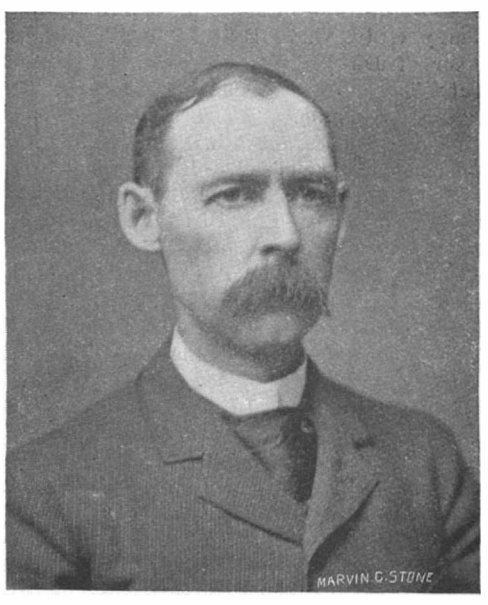
HON. A. R. SPOFFORD LIBRARIAN OF CONGRESS.



CYRUS F. BRACKETT LL.D. M.D. PROFESSOR OF PHYSICS, PRINCETON UNIVERSITY.



HON. JOHN LYNCH MEMBER CENTRAL COMMITTEE.



MARVIN C. STONE MEMBER CENTRAL COMMITTEE.

THE CENTENNIAL CELEBRATION OF THE AMERICAN PATENT SYSTEM.

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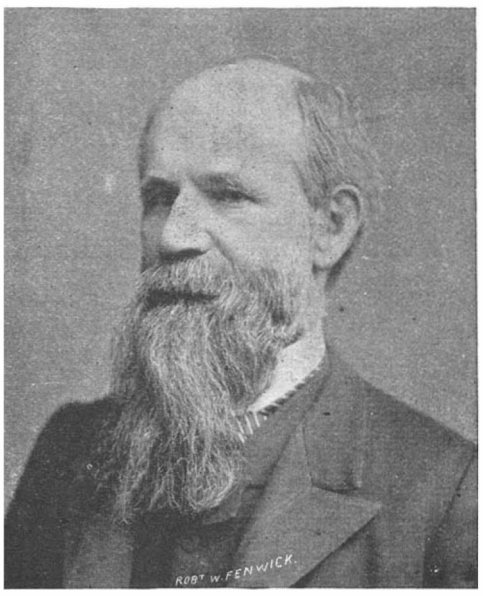
private business as an electrical engineer, in which he has continued until this time. He has been an extensive builder of telegraph lines, organized, and, for five years, managed the telephone business in Washington, and has been connected with many electrical enterprises. He is a member of the American and English Institutes of Electrical Engineers, president of the "Old Timers'" telegraph society and the Washington editor of the *Electrical Review*.

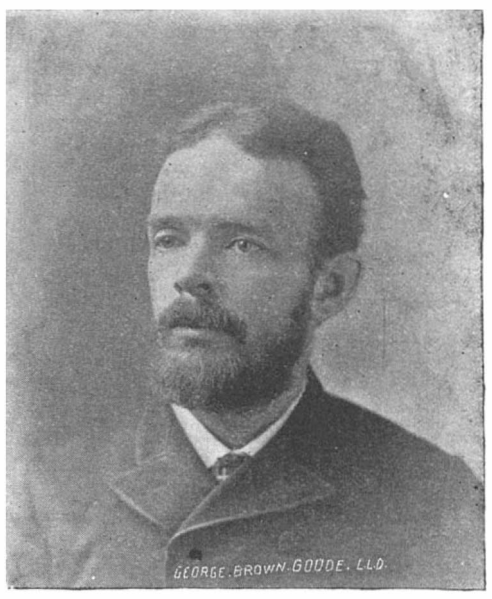
General, and assigned to the Interior Department. In 1881, he was appointed, by President Arthur, Commissioner of Railroads, holding this position with the Assistant Attorney-Generalship. In May, 1885, he resigned from public service, since which time he has beeen practicing his profession in the city of Washington. He has been president of the Cosmos Club, of Washington, and is a member of several learned societies and social organizations.

laws. Mr. Britton is president of the American Security and Trust Company and vice-president of the Columbia National Bank.

James T. Du Bois was born at Hallstead Pennsylvania, in 1851. He graduated at the Ithaca Academy in 1871. President Hayes appointed him consul to Aix-la-Chapelle, Germany, in 1877. He was transferred to the consulate at Callao, Peru, in 1883, and to the consulate at Leipsic during the same year. In 1889 Mr.

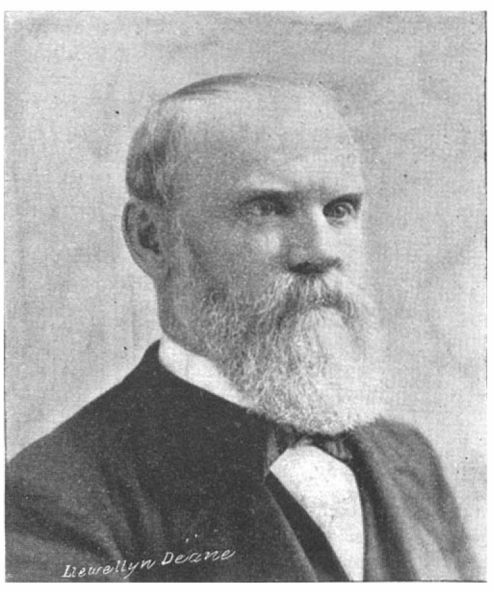


ROBERT W. FENWICK MEMBER CENTRAL COMMITTEE.



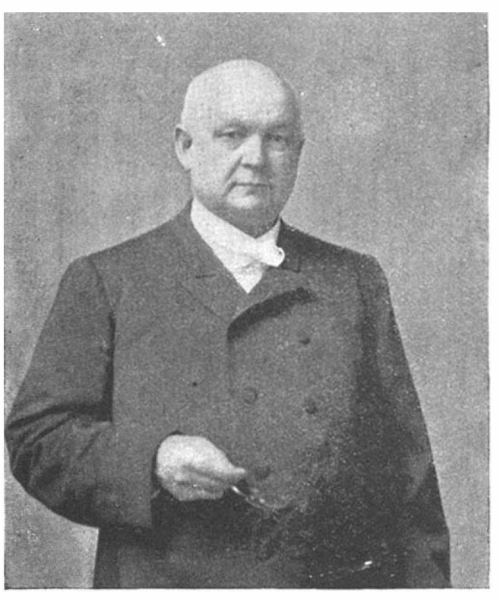
DR. G. B. GOODE, ASSISTANT SECRETARY U. S. NATIONAL MUSEUM.

J. ELFRETH WATKINS, CURATOR U. S. NATIONAL MUSEUM.



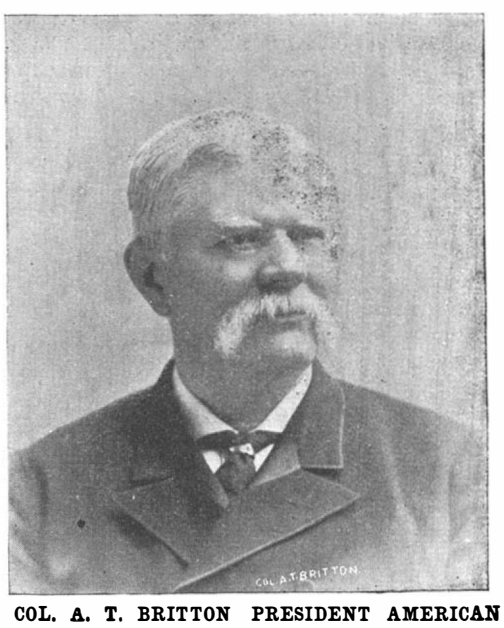
LLEWELLYN DEANE.

GEORGE C. MAYNARD MEMBER EXECUTIVE COMMITTEE.

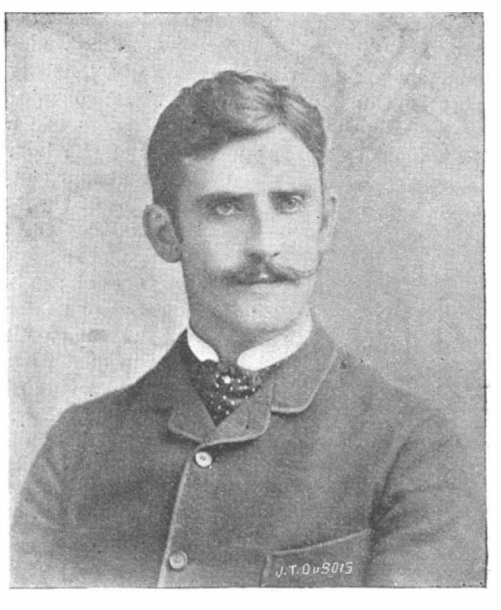


J. M. TONER M.D.

J. K. McCAMMON.



COL. A. T. BRITTON PRESIDENT AMERICAN SECURITY AND TRUST CO.



J. T. DU BOIS.

THE CENTENNIAL CELEBRATION OF THE AMERICAN PATENT SYSTEM.

Hon. Joseph K. McCammon, chairman of the Finance Committee, was born in Philadelphia, October 13, 1845. He graduated, in 1865, from the College of New Jersey, at Princeton. In 1868 he was admitted to the bar in Philadelphia; in 1870, appointed register in bankruptcy; and in 1871, special counsel for the United States before the Court of Claims, having special charge of suits in which the Pacific and other railroads were engaged in litigation with the government. In 1880, he was appointed Assistant Attorney

Alexander T. Britton, of the Advisory Committee, was born in New York City in 1835. He studied law in the office of James T. Brady, and subsequently went to college and graduated at Brown University. He has built up a large law business in Washington under the firm name of Britton & Gray, and in the department of railroad and corporation law has acquired an extended reputation. He was appointed by President Hayes a member of the Public Land Commission, and in that capacity revised and codified the public land

Du Bois established the *Inventive Age* at Washington, D. C. He has been an earnest promoter of the patent centennial celebration.

J. Elfreth Watkins, of the U. S. National Museum, Washington, has been the efficient secretary of the organization committee, and taken upon himself a large amount of the necessary detail work.

Dr. J. M. Toner, of Washington, a member of the advisory committee, has also been an active and efficient promoter of the movement for this celebration.

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OPTICAL PROJECTION OF OPAQUE OBJECTS.

BY GEO. M. HOPKINS.

The projection of opaque or solid objects by means of the optical lantern affords a way of showing upon the screen a large variety of objects in their natural colors, and greatly magnified. The form of lantern best adapted to this purpose is the simplest imaginable.

The works on optical projection briefly describe different forms of apparatus for this purpose. Prof. A. E. Dolbear in his book describes a megascope, consisting of a plain box, with a large lens in front and an oxyhydrogen light within. Mr. Lewis Wright, in his new work on "Optical Projection," shows two or three forms of megascope; but notwithstanding all this the idea is current that opaque projection is difficult, and several persons known to the writer are so thoroughly convinced of the magnitude of the undertaking that they do not make the attempt to project in this way.

In describing a few ways of opaque projection two or three points are noticed in the beginning. First, all the light attainable is required; second, all kinds of work cannot be done with one and the same instrument; and third, to secure the best effects, suitable shadows are as necessary as strong lights. It is useless to attempt projection on a large scale with a source of illumination inferior to the calcium light. For large objects and a large screen, two large burners are essential, and the use of three insures a much better effect.

The length of the box inclosing the object and the burners is determined by the focal length of the object glass. In the instrument illustrated, the lens has a

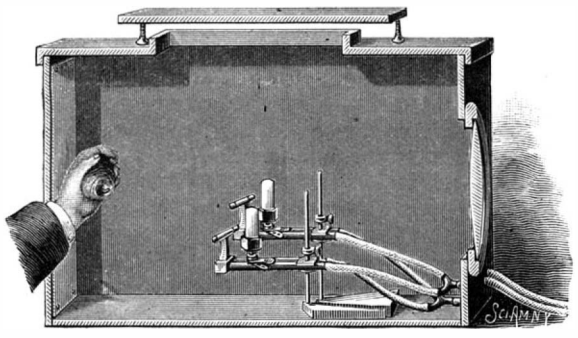

Fig. 2.—MEGASCOPE BOX, SHOWING POSITION OF BURNERS.

focal length of 24 inches. The box is made 4 inches longer, *i. e.*, 28 inches, to allow of moving the object, for the purpose of focusing the image on the screen.

When two oxyhydrogen burners are used, they are arranged at one side of the megascope box, at slightly different elevations, and a short distance apart to secure soft shadows. When three burners are used, the third is placed at the opposite side of the box. It increases the volume of light and modifies the shadows. If the apertures of the burners are the same, they may all be supplied with gas from a single pair of cylinders, by using branch pipes. The burners should be pushed as near the object as possible, without bringing them into the field of the objective.

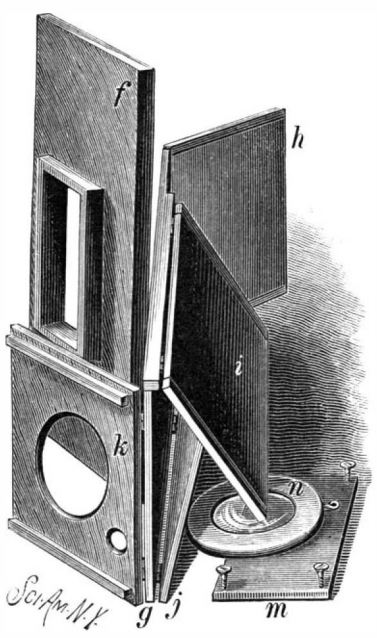

Fig. 3.—FOLDING BOX PARTLY CLOSED.

In the present case the objective consists of a 6 inch double convex lens, but a 7 or 8 inch would be better. The lens is mounted in a soft wood ring, and suspended over a circular aperture in the front of the box.

For the sake of convenience, the box is made to fold, so as to occupy a space of 18 by 28 inches, by 3 inches thick, when not in use. Fig. 3 shows the construction clearly. The top, *f*, is like an ordinary box cover, with the exception of the central draught hole surrounded by a collar.

To the bottom, *g*, are hinged the end, *h*, sides, *i j*, and the front, *k*. The cap, *m*, is supported over the opening in the center of the cover, *f*, by the wood screws inserted in the corners. The lens, *n*, is arranged to hang over the large opening in the end piece, *k*. In this end piece there is a smaller opening for the insertion of the gas tubes. The side piece, *i*, is discontinued near the back end of the box, to provide an opening for the insertion and removal of objects. This opening is covered with a black curtain, which falls over the arm, and prevents the escape of light. Upon the inner surface of the back end of the box is secured a piece of white cardboard for a background.

The sectional view, Fig. 2, best shows the internal arrangement.

The object must be inserted in position and moved forward or backward until it is focused. If difficulty is experienced in holding the objects properly for exhibition, they may be placed on a movable support.

Fruit of all kinds projects well, either whole or divided. A bunch of California grapes forms a fine object. A bouquet of flowers is beautiful. Shells, especially polished ones, are very pleasing objects. Peacock and other feathers show well. Pottery and bronzes, plaster casts, toys of various kinds, particularly of the Japanese variety, carvings, embroidery, paintings, engravings, photos, the pages of a book, are all of interest. Whole machines of a suitable size, and parts of machinery, or apparatus of almost any kind may be shown to advantage in this way.

Another way of accomplishing the same result without the use of a box is illustrated in Fig. 4. In this case one room serves as a megascope box and another as the room in which to place the screen. The same general arrangement as that already described is observed. In this case the lens is secured over the space between two sliding doors, and all escape of light is prevented, excepting of course that which passes through the lens. The screen is made of translucent tracing paper. The lens may be such as is used for the examination of paintings or photographs, but the kind known as cosmorama lenses, sold by the principal opticians, are preferable, on account of being about the right focus. They are not expensive, and may be obtained of a diameter of six or seven inches. Two or three calcium lights are used. The objects may be held in front of a white or tinted background, or the background may be omitted. It is absolutely necessary that no stray light should escape into the room in which the image is thrown. Of course an opaque white screen may be used in this arrangement if desirable.

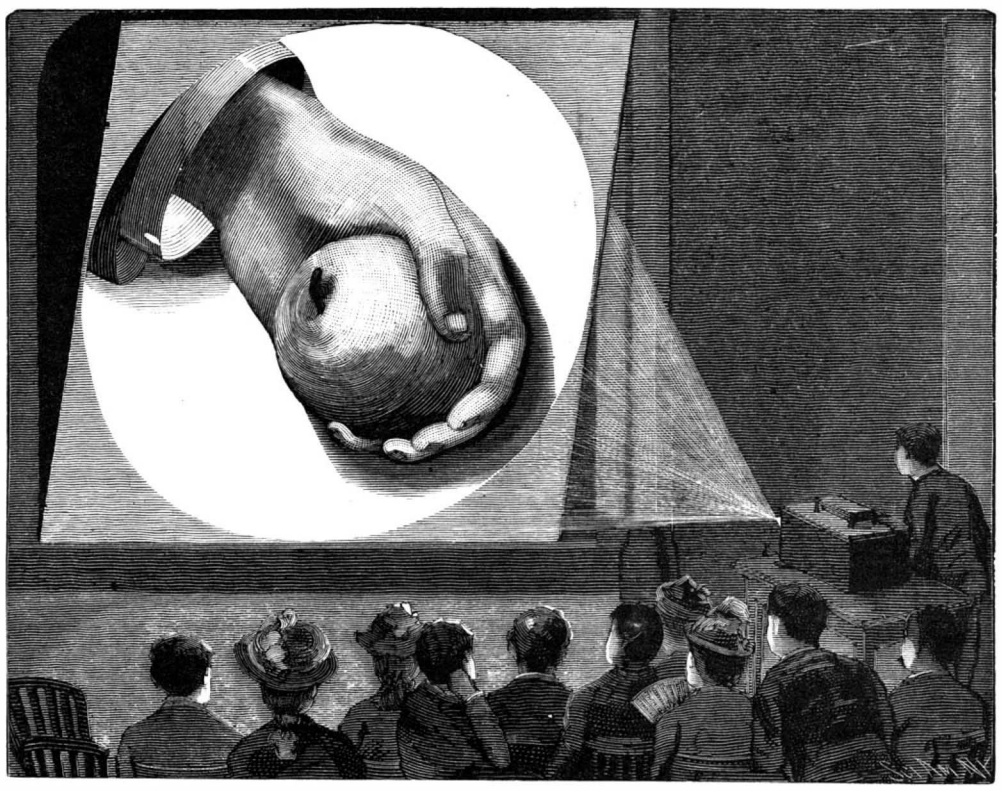

Fig. 1.—THE MEGASCOPE.

For the projection of fine objects, such as gems and their settings, a watch movement, or a fine piece of machinery or apparatus, the arrangement shown in Fig. 5 is effective. A plan view of the apparatus is here shown. The objective of the lantern is removed and supported at an angle with the optical axis as indicated. The lime is pushed forward so as to cause the divergent cone of light to cover the object, *d*, as shown. The light reflected from the object, *d*, passes through the objective to the screen.

The wire frame, *e*, secured to the front of the lantern and held by the standard, *f*, is designed to support a thick black cloth for shutting in all light excepting that passing through the objective. Apparatus similar to this in principle is sold by some of the dealers in lanterns.

The wonder camera shown in Fig. 6, on opposite page, is an instrument having a marvelous amount of power considering the source of light, which is simply a single Argand kerosene burner. This toy is furnished by Ives, Blakeslee & Williams Company, of this city.

The lamp flame is in one focus of the ellipsoidal reflector and the picture or object to be shown is placed at the other focus, on the swinging adjustable holder. Opposite the holder in a perforation in the reflector is placed the objective by which the image is projected on a screen three or four feet distant. The small plan view shows the shape of the mirror and the course of the light. The linings of the box around the lamp and focus of the reflector are

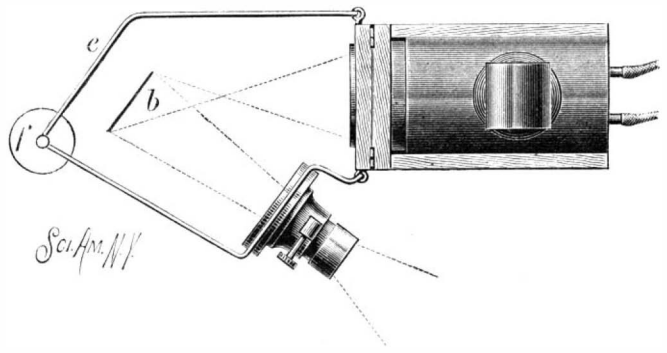

Fig. 5.—MEGASCOPE ATTACHMENT TO LANTERN.

removed in the picture to show the interior. These linings are made of asbestos, to withstand the heat. This instrument will project coins, shells, flowers, pictures, etc., very satisfactorily.

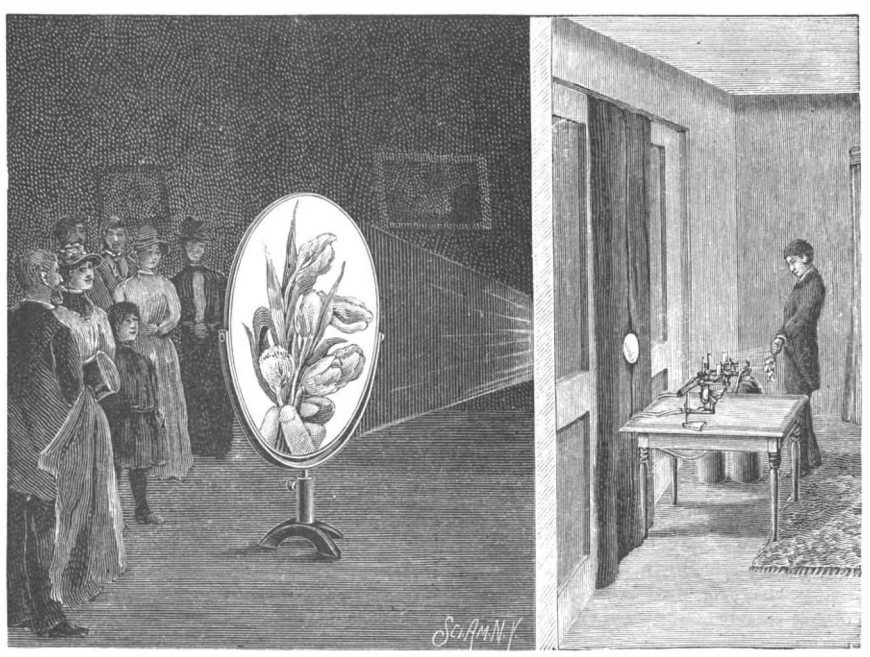

Fig. 4.—MEGASCOPE WITHOUT BOX.

GAS for illuminating purposes is sold by a private company at Plymouth, England, for 1s. 9d. per 1,000 feet, and at Leeds it is sold by the local authorities for 1s. 10d. per 1,000 feet. This is equal to 42 and 44 cents respectively, and in both cases the business is done at a profit. According to the prices charged for gas in most American cities, there is evidently a large margin for profit.

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Manufacture of Aluminum.

A suit has been brought against the Cowles Electric Smelting and Aluminum Company, by the Pittsburg Reduction Company, of Pittsburg, in the United States Circuit Court, and the Pittsburg Reduction Company moved for a preliminary injunction to stop the Cowles Company from manufacturing pure aluminum at its works in Lockport, N. Y., under what the Pittsburg Company alleges is the Hall process, covered by letters patent owned and controlled by itself.

A large number of affidavits is filed by the Pittsburg Company in support of its motion. Alfred E. Hunt makes affidavit that he is the president of the Pittsburg Reduction Company, and has been since 1876 a civil and metallurgical engineer and chemist. For some years he has made pure aluminum a special study, realizing that in due time, if its manufacture could be made more inexpensive, it would be an important article of commerce in the mechanical arts. It was not until 1888 that he heard of the Hall process of reducing aluminum electrolytically from a fused bath of fluorides containing alumina in solution. The patented process was secured and the Pittsburg Reduction Company organized. It was successful and in due time was enabled to establish works in Pittsburg and in Great Britain and to manufacture and sell pure aluminum at $1.50 and $2 a pound, where previously it had been sold as high as $12 a pound. Until January, 1891, the Pittsburg Reduction Company was the only manufacturer of aluminum in this country, though many concerns applied to it and were refused on the ground that the Pittsburg Reduction Company could supply all the demand and desired to retain the exclusive use of the Hall patent. In the spring of 1890, Eugene Cowles, of the Cowles Smelting and Aluminum Company, notified Mr. Hunt that a concern in Boonton, N. J., was manufacturing pure aluminum by the Hall process, and on this hint the New Jersey concern was investigated, owned up, and desisted. The Cowles people have made overtures to the Pittsburg Reduction Company to unite patents, but have been refused, and last month began manufacturing pure aluminum in Lockport. Mr. Hunt declares that this was done to harass his company into a combination and thus secure to the Cowles Company the value and use of the Hall process. The Cowles Company has been offering pure aluminum at $1.25 and has even quoted it at $1. Prior to January the Cowles Company has not pretended to make pure aluminum and has referred purchasers to the Pittsburg Reduction Company for it. Mr. Hunt says that the Cowles process is an alloy process and not adapted to produce unalloyed metallic aluminum.

Among the other affidavits is that of Henry P. Moore, of Pittsburg, who says that he worked as a laborer over night in the Cowles works at Lockport, and who describes the manufacture that went on there. Moore describes the plant as being situated on an island in a swift and turbulent stream, guarded by watchmen night and day, with doors barred and windows painted within and without.—*Cleveland Plain Dealer.*

Heart Sounds at a Great Distance.

Dr. Guido Bell, who had previously reported in the *Memorabilien* a case in which, after contusion of the thorax, the hearts sounds were plainly audible the whole length of the room, and even further, now publishes a second case of a similar kind. A large and heavy but healthy man had, in the presence of the author, fallen backward from an open vehicle to the street, and in a state of unconsciousness was carried the short distance to his house. He had fallen on his right shoulder and had fractured several ribs, but without injuring the pleura. His breath was short and superficial, the pulse frequent and very small, the pupils of moderate size, but insensible to light, the eyes open and expressionless, the skin cool and pale.

When the patient was placed in bed the heart sounds were very loud at the distance of a foot. This abnormal loudness lasted half an hour. The patient recovered after a serious attack of pleurisy, and both he and the patient previously referred to are now strong and well. Both patients had been under the influence of shock while these peculiar symptoms lasted, and these are in Dr. Bell's opinion merely symptoms of shock. Assuming that in low vitality of the vagus and sympathetic the ganglia of the heart may have increased activity, he considers that we may look upon the increased action of the heart as simply a symptom of shock. The author considers his theory proved by the fact that each nerve system, besides being under the control of the brain, also has an independence of its own, with ganglia for centers. The spinal cord, and still more the sympathetic, certainly have this independence, and probably also every other ganglion in a corresponding manner. When the influence of the brain as nerve center has ceased to be felt in any organ—the heart for instance—this may still exercise its independent activity, and especially so when its antagonist has become inactive. Even the apparent contradiction of a small pulse with increased action of the heart could be explained by assuming a certain independence of the ganglia. This independent action is further increased by the narrowing of all blood vessels through paralysis and consequent increased resistance. —*Lancet.*

A Gigantic Railway Property.

The Pennsylvania Railway system is called an "empire" by an Eastern contemporary, and well it may be, measuring it by the magnitude of its receipts and disbursements. The gross earnings of the entire system for the calendar year 1890 were $133,531,623, and its expenditures were $92,603,325. Never before 1864 did the United States collect so large a revenue, and never before, except in time of war, did it expend so much in a single year. But it is the net earnings rather than the aggregate business that those who look forward to government ownership of the railroads will

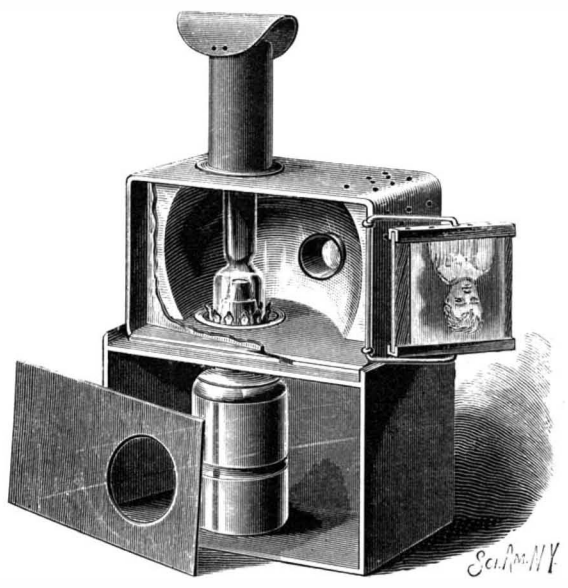

Fig. 6.—WONDER CAMERA.

regard with the greatest interest. The net earnings were $41,518,258. These earnings were realized on 7,915 miles of road operated—2,435 east of Pittsburg and Erie, and 5,480 west of those points. The net earnings, therefore, were about $5,255 per mile of road operated. The capital stock, including nearly $9,600,000 issued last year, is $123,082,050, or about $15,580 per mile of road operated. The net earnings were not far from one-third of the capital stock in a single year. It is to be borne in mind that the capital stock represents very much less than the actual value of the property, estimating the value at cost, and not on the basis of earning capacity. The roadbed, rails, and bridges could not be duplicated in their present state of solidity and general excellence for less than double the amount of capital stock, to say nothing of locomotives, cars, depots, shops and machinery, right of way, etc. Still, the earnings were unquestionably a large percentage of the amount which it would cost to duplicate the entire property at present prices of materials and labor, assuming that the right of way could be obtained at something like the original cost. Arguing from this system alone, therefore, it might be contended with some plausibility that railway earnings are excessive. But it must be remembered that this system is exceptional. Its mileage is less than one-twentieth of the aggregate mileage of the country, but its gross earnings were not far from one-ninth of

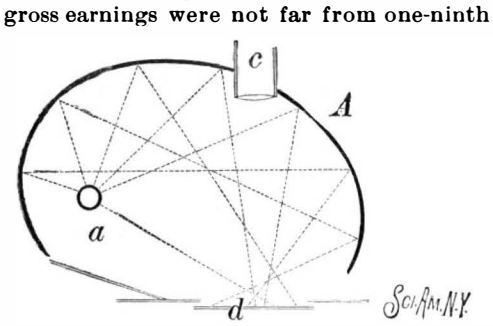

Fig. 7.—PLAN OF WONDER CAMERA.

the gross earnings of all other roads. Its earning capacity, therefore, is considerably more than double that of other roads on the average, although its tariffs are low, and lower than those of most roads, especially those that stretch through comparatively unsettled regions and are more remote from the great centers of traffic.—*Chicago Herald.*

Eucalyptus Extract as a Scale Remover.

Many of the railways in India traverse calcareous regions that produce water as badly impregnated with lime salts as anything to be found in our Western States. The result is that how to keep boilers free from incrustation is as pressing a problem as it is on many of our railroads. Of course all sorts of remedies have been tried, and the quack with his lotions was driving a roaring trade, as he always does where a malady is raging that defies the skill of the regular practitioner. There are few chemicals with the least affinity for lime that have not been tried as a preventive of scale, and numerous mechanical appliances, guaranteed to prevent incrustation and to remove with certainty and dispatch what has been formed, all had their day and were declared to be wanting in utility. The case appeared to be growing hopeless, and the men in charge of the motive power were concluding that the constant calking, patching and renewing of sheets was inevitable, when some one tried the extract of eucalyptus leaves. This is reported to have proved an effectual anti-incrustation agent.

The eucalyptus is an Australian gum tree which thrives in all warm climates. It has a thick glossy leaf which stands upright and receives the rays of the sun on both sides. The leaves are rich in a volatile oil, which is the substance that acts on the lime salts with the effect that formation of scale is prevented. There are many regions in the Southern States where the eucalyptus tree would thrive and do good, for its presence is reported to be a specific against malaria. The tree was planted extensively in the swampy regions near Rome and is said to have greatly decreased the malarial fevers of the districts.

The extract of the leaves for use in boilers of the Indian railways is obtained in a very simple fashion. The leaves are collected and slowly boiled, about one thousand gallons of strong fluid being produced from fifty pounds of the leaves. Three gallons of this extract is used for a trip of 100 miles, and keeps the boiler in the condition that all impurities deposited by the feed water can be readily washed out. When a boiler is foul with scale, about twelve gallons of the eucalyptus extract is put in after washing out, and the incrustation immediately begins to soften, and soon falls off in large pieces. By keeping up the treatment and washing out thoroughly, the worst boiler will be cleaned in about two months.—*Nat. Car Builder.*

Advice to a Young Man.

So you were a little too pert, and spoke without thinking, did you, my son? And you got picked up quite suddenly on your statement, eh? Oh, well, that's all right; that happens to older men than you every day. I have noticed that you have a very positive way of filing a decision where other men state an opinion, and you frequently make a positive assertion where older men merely express a belief. But never mind; you are young. You will know less as you grow older. "Don't I mean you will know more?" Heaven forbid, my boy. No, indeed; I mean that you will know less. You will never know more than you do; never. If you live to be 10,000 years old, you will never again know as much as you do now. No hoary-headed sage, whose long and studious years were spent in reading men and books, ever knew as much as a boy of your age. A girl of fifteen knows about as much, but then she gets over it sooner and more easily. "Does it cause a pang, then, to get rid of early knowledge?" Ah, my boy, it does. Pulling eye teeth and molars will seem like pleasant recreation alongside of shredding off great solid slabs and layers of wisdom and knowledge that now press upon you like geological strata. "But how are you to get rid of all this superincumbent wisdom?" Oh, easily enough, my boy; just keep on airing it; that's the best way. It won't stand constant use, and it disintegrates rapidly on exposure to air.—*Burdette, in the Brooklyn Eagle.*

Ten Wheeled Locomotives.

The demand of the time is to move weight over distance at the least possible cost to it on slow freight or fast passenger trains. There are hundreds of locomotives in service of about 40 tons weight capable of hauling a train of 100 tons at the average running rate of 60 miles an hour. But that is not the kind of fast train that our railroad managers want. They are required to make money for the companies employing them, and they realize that it pays much better to use locomotives weighing sixty tons that are capable of hauling a fast train of 300 tons. It is a curious study, and one that is interesting to some minds, to investigate the rapid speed that might be made with safety with locomotives having abnormally large drivers, but as far as the bearing on American railroad operating is concerned, it is just as practicable as speculations or calculations respecting the time it would take a balloon of certain proportions to reach the moon. Locomotives with a single pair of driving wheels had their day on our railroads, and when business increased, the four wheel connected engine took possession of the field. This type of locomotive held its own so long that it became known as the "American locomotive." That kind of engine did admirable service, but the indications are that its days as the motive power for fast passenger trains are nearly over. Running two trains where one will suffice is not good railroading, and trains are becoming so heavy that two pairs of drivers and a four wheel truck will not carry the weight of the boilers and cylinders necessary to provide the required power. The mogul and the ten wheel locomotive are slowly taking the place they will eventually monopolize. To talk of employing single driver locomotives at this day is trifling with a serious subject.—*Nat. Car Builder.*

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RECENTLY PATENTED INVENTIONS.

Mechanical.

SETTING ENGINE VALVES.—Frederick W. Williams, Minneapolis, Minn. This is a device for alternately adjusting and holding in position the lost motion of valve gearing during the process of setting the valves and eccentrics, the invention consisting of springs adapted to exert a pressure on the valve alternately in both directions in line with the travel of the valve.

MECHANICAL MOVEMENT. — William C. Eich, Harmonsburg, Pa. Combined with a shaft on which is a series of ratchet collars is a parallel shaft on which a series of pawl-carrying levers is journaled, a drive shaft having disks with projections adapted to engage the levers alternately, with other novel features, whereby a shaft may be continuously operated by means of a leverage to give greatly increased power.

FLOUR BOLTING APPARATUS.—Victor Monnier, Grafton, North Dakota. This invention covers an improvement in vertical centrifugal bolting mills, the apparatus including a series of horizontal revolving disks arranged one above another and a like series of revolving screens or bolts surrounding them, while a series of annular tubes is located at lower points than the disks and exteriorly of the screens.

Electrical.

COMMUTATOR TRUER. — David McGenniss, Amsterdam, N. Y. A pair of adjustable guides is fitted to the brush-holding arm of a commutator, a sliding rod is fitted to the guides, and a plate carried by the sliding rod is furnished with the desired character of abrading or cutting surface, forming a simple attachment for truing the commutators of dynamo-electric machines or motors worn by the friction of the brushes and the action of the current.

Agricultural.

LEVELER FOR HARROWS.—Lorenzo D. Corser, Ebensburg, Pa. This is an auxiliary device for use in connection with a harrow, and capable of adjustment with regard to the ground surface engaged to level all inequalities after the harrow teeth have operated on the plowed ground, the depth of the toothed engagement of the harrow with the soil being also controlled by improved means.

CHURN. — John F. Adams, Aledo, Ill. This is an improvement in churns having vertically reciprocating dashers, the churn also being provided with means for regulating the temperature of its contents while in use, and for ascertaining the exact temperature of the cream within the churn during the churning process.

Miscellaneous.

STOP WATCH. — Charles Schlatter, Hoboken, N. J. This invention is designed to simplify and improve the starting and stopping mechanism of stop watches, and consists in combining with the main wheels of the stop movement the wheel of the seconds hand staff or fourth wheel staff and the wheel on the staff of the stop hand, an intermediate wheel or wheels being arranged to be oscillated to put the stop movement in and out of action.

ILLUMINATED CLOCK. — Austin A. Dubois, Brooklyn, N. Y. In this clock a dial is mounted on an hour hand tube and a lamp rests on the dial, the lamp globe having the hours of the day thereon, and the lamp and globe being rotated by the clock mechanism, when the time is indicated by a stationary hand on the outside of the globe, the clock being also adapted for day use.

TIME RECORDER. — Francis E. Tyng, Irvington, N. Y. This is a device designed to easily and accurately record the hours of labor of a large number of people, and has a cylinder with time card on a suitable shaft, a dial plate connected by gear with the cylinder, a frame on shafts above the cylinder provided with means for marking the time card, and a clock movement connected with the frame, it being designed that in using the invention each employe shall have a particular number corresponding with a number on the time card and on the dial plate.

BALLOT BOX.—Calvin Jackson, Jacksonwald, Pa. This box has two compartments, one to hold the bulk of the ballots and the other to receive ballots cast, communication between the two compartments being controlled by a transfer mechanism for shifting the ballots in single succession from the main compartment to the receiving compartment, the box being designed to facilitate balloting in secret by clubs, societies, etc.

AERATOR. — Lizzie F. Wood, West Lebanon, N. H. This is a portable device having a receiver near the top of a standard, the receiver having numerous small perforations, while lower on the standard are pans, also provided with perforations, for the aeration of warm and fresh milk, to facilitate cooling it and cause a rapid separation of the cream, the device being also applicable for other purposes, as the cooling and straining of sirups, the aging of liquors, etc.

ANIMAL COLLAR. — Gustav R. Sagelsdorff. Medford, Wis. This collar is formed of a light and cheaply manufactured chain which can be readily locked and unlocked, and is provided with a middle piece adapted to support a bell.

HORSE DETACHER.—David F. Sloan, Mattapan, Mass. This is a device adapted for attachment to any shaft, whereby the driver may readily sever all connection between the harness and the shaft, allowing the animal to escape, while the shafts will be held up and may be controlled to guide the vehicle till it stops, provision being also made for dispensing with the ordinary traces and whiffletree.

SPOOL RACK.—Charles H. Lewy, New York City. This is an attachment for sewing machines, consisting of a rotatable table adapted to contain a number of spools, each capable of independent rotation, while the spools cannot be removed except by one having the key of the locking device, although the empty spools may be quickly and conveniently removed and filled spools substituted therefor.

KITCHEN CABINET. — Henry C. Armstrong, David E. Bigelow, and George L. Osborn, Ashland, Wis. This is a combination device for holding flour and sifting it, with the spices and other ingredients used in making bread and pastry, also providing a bake board and the implements needed, and an adjustably supported table hinged to let down at the side of the cabinet when not in use.

TRUNK AND BED. — George W. Snaman, Jr., Allegheny, Pa. This is a convertible device adapted to form a compact folding bedstead for use by parties camping out, while capable of holding the bedding and articles of personal wear when changed into the form of a trunk, a removable covering or screen being also provided to shield the occupant from attacks of insects.

CUFF HOLDER. — Asa A. Mehaffey, Poplar Bluff, Mo. This invention provides a slide having a spring clamping finger, a spring catch with lugs attached to it, and a body having a slot and notches, making an improved device for attaching cuffs to coat sleeves instead of to the shirt sleeves.

DEVICE TO TEST CIGARS. — Gabriel Balbin, Brooklyn, N. Y. This invention provides a holder adapted to receive the tips of cigars, from which connection is made to a rear chamber and the latter connected with a suction apparatus, whereby a uniform suction may be employed upon the cigars, that the manufacturer may judge of the burning qualities of different tobaccos.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE LOCOMOTIVE. New Series. Vol. XI. The Hartford Steam Boiler Inspection and Insurance Co., Hartford, Conn. 1890. Pp. 194. Illustrated.

This is the bound volume of a little periodical published monthly in the interest of boiler users. It contains much practical and interesting matter on boiler explosions, practice and construction.

MAPS OF THE UNITED STATES, SHOWING THE CENTRAL STATION PLANTS AND ELECTRIC RAILWAYS AND SYSTEMS IN OPERATION. The Thomson-Houston Electric Co., Boston, Mass. 1891. Pp. 93.

These are a series of skeleton maps showing the location and type of electric stations all over the United States. The preponderance is largely in favor of the Thomson-Houston system.

MIXED METALS OR METALLIC ALLOYS. By Arthur H. Hiorns. London: Macmillan & Co. New York. 1890. Pp. xvi, 384. Price $1.50.

The subject of alloys is one which has, in recent years, acquired a new impulse on account of the new combinations of metals. It has been brought before the public by recent lecturers and by the introduction of new alloys into engineering practice, such as aluminum bronze, manganese bronze, and other compounds of that class. The present book is well up to the times, treating of the last modifications of metallic mixtures, and with the numerous tables of analyses and illustrations as required, forms a valuable addition to technological literature.

RUBBER HAND STAMPS, AND THE MANIPULATION OF RUBBER. By T. O'Conor Sloane, A.M., E.M., Ph.D. New York: Norman W. Henley & Co. 1891. Price $1.

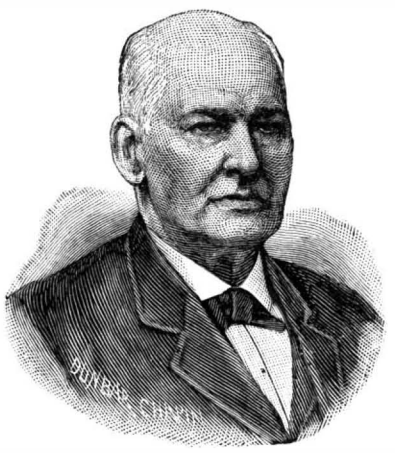
Probably thousands of young people have first attempted the doing of a little business on their own account by making rubber hand stamps and finding customers therefor among their neighbors. It is somewhat in the same line as the work of amateur printers, of whom there are so many in every section, but the detail connected with the making of stamps is more simple, and a moderate degree of success is easily attained with but little labor and a very small outlay. To all such beginners this book gives full details on all points, and it also has a great deal more, giving in a concise and simple form the elements of nearly everything it is necessary to understand for a commencement in any branch of the India rubber manufacture. The making of other small artiles of rubber, and of the hekotograph, or copying pad, together with a variety of special inks and cements, is also set forth in a manner designed to be readily understood, the explanations being plain and simple. The author has had an extended experience as a lecturer, and understands the art of presenting facts and describing processes in an interesting and attractive manner.

A TREATISE ON ELECTRO-METALLURGY. By Walter G. McMillan. London: Charles Griffin & Company. Philadelphia: J. B. Lippincott Company. 1891. Pp. xvi, 387. Price $3.50.

The trade is paticularly addressed in this work, and the requirements of electrotypers and electroplaters are all fully taken into view. Among the details of the different branches of the practice, electric conductivity, units of measurements, switch and resistance boards, electro-chemical equivalents, battery connections, and Ohm's law illustrated mark the more scientific part of the work, and useful tables add to the value of this department. In the practical portion, every detail liable to be wanted by the actual operator is fully considered. An excellent glossary of substances and an index nearly 27 pages in length are features—the latter one worthy of special notice.

Special.

A Successful Life.



JOHN P. LOVELL,
President of the
JOHN P. LOVELL ARMS CO.

In the many thousand homes where the SCIENTIFIC AMERICAN is read each week there are perhaps hundreds of thousands of young people growing into manhood and womanhood who should not fail to know some of the leading features which make up a successful business life. Every city and town has its examples, with which some are familiar, but seldom has a life been so marked with the fruits of integrity and uprightness, and a success become so widely known, as in the person of Mr. John P. Lovell, who recently celebrated the golden anniversary of his establishment in the business now known as the John P. Lovell Arms Company, in Boston. Some of the best business men of our country have recognized the characteristics which have led to this man's success, and a brief account of his life may inspire many a young man to follow the example which not only leads to personal happiness, but successfulness and a benefit to the world.

Mr. Lovell was born in East Braintree, July 25, 1820. At the age of eleven he left school and went to work in a cotton factory. One year later his mother opened a boarding house in Boston, and John had another year of schooling. With this scant equipment, but with an indomitable determination to succeed, this boy of thirteen entered into the arena of life's battle.

The years that followed found the lad making a noble fight against the disadvantages with which he was surrounded. After an eventful life in various lines of trade, he settled down to the gunsmith business in the employ of A. B. Fairbanks, to whom he became apprenticed at a weekly salary of $2, with $25 yearly allowance for clothes, and a raise of fifty cents per week and $10 per year additional clothing allowance for each succeeding year until the age of twenty-one.

The qualities which in later years developed the man of large enterprise and unswerving integrity took firm root in the gunsmith boy, and Mr. Fairbanks was so gratified with his success that, when John was twenty years of age, the old gentleman voluntarily took him in as a partner, with one-half interest. At this time John had not a dollar in the world.

Thus, fifty years ago, was formed the firm which to-day is represented by the great house of John P. Lovell Arms Co., whose business radiates throughout the world.

John's profit for the first year was $700. In 1841 Mr. Fairbanks died, and Leonard Grover entering, the firm became Grover & Lovell. In 1844 John P. Lovell bought out his partner's share, and with renewed zeal pushed his business toward the high mark of success which he had set before himself in his youth. As the years sped by, his name and fame traveled from city to city. Through the ranks of the sporting goods dealers of America he hewed his way from the lowest to the highest place of success, until with honest pride he felt his feet securely planted on the high ground to which in boyhood days, when poor and unknown, his ambition had aspired. His family had grown up around him in the intervening years, and he now beheld his sons, developed into men, ready to assist him in his old age to carry to a further success the enterprise begun years before. The John P. Lovell Arms Company was then formed, with J. P. Lovell, President; Col. Benjamin S. Lovell, Treasurer; Thos. P. Lovell, Director; H. L. Lovell, Clerk of the Corporation; and W. D. Lovell.

In 1874 the business was removed to the present spacious buildings in Boston, which are located in the business center of the city.

Here daily may be seen John P. Lovell, no longer the young man whose steps are elastic in the pursuit of lofty ambitions, but John P. Lovell the man of years, who has trodden life's pathway through both the bitter and the sweet, and has emerged from its shadows and contests a man of success, both in the development of wealth and of character.

It is in viewing old age where the years have been spent in integrity of action that we behold the sum of many virtues, the fruits of which are a peaceful and contented winter sustained by a rich harvest, the seeds of which were planted and perseveringly watered in youth.

The lesson to be learned is not in the accumulation of wealth alone, but in the possession of those sterling qualities of integrity and manhood which command the universal respect of man. These lives are examples to set before the young men of America, lights to guide them in safety on a road which has many a dark and dangerous path into which they may stumble, unless the illumination from other lives points them clearly to the straight road of unblemished integrity.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

For Sale—New and second hand iron-working machinery. Prompt delivery. W. P. Davis, Rochester, N.Y.

Acme engine, 1 to 5 H. P. See adv. next issue.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Burnham standard turbine. Burnham Bros., York, Pa.

Best Ice and Refrigerating Machines made by David Boyle, Chicago, Ill. 155 machines in satisfactory use.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 13.

For the original Bogardus Universal Eccentric Mill, Foot and Power Presses, Drills, Shears, etc., address J. S. & G. F. Simpson, 26 to 36 Rodney St., Brooklyn, N. Y.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

For Sale Cheap. One Horizontal Slide Valve Engine, 8 inch cylinder, 16 inch stroke, with pulley, with assortment shafting, pulleys, steam pump, 10x5x14. Address H. T. Bartlett, 200 Lewis Street, New York.

The Dwight Slate Machine Co., of Hartford, Conn., make the most extensive line of hand, foot, and automatic feed drills for light work, ½ in. holes and less. 1891 catalogue free.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(2927) L. E. M. asks if, in the using of pearl agate ware, it becomes dangerous after the lining peels off? A. We believe not. All ordinary agate ware is made on an iron basis, and is quite innocuous under all circumstances, and we presume the same applies to the special agate ware you mention.

(2928) A. W. B. writes: Last spring I constructed a cement cistern for storing maple sap. The sirup made from this sap was dark colored and had a strong taste. Was it the fault of the cistern? If so, what can I paint it with that will obviate the difficulty? A. It is very doubtful if the cistern had anything to do with your trouble. If it had, the trouble will probably cease. The taste and odor of the sugar would reveal to some extent the cause.

(2929) A. O. writes: I have a very nice meerschaum pipe, which has commenced to color very irregularly. Can you give me some remedy employed by pipe experts for removing the nicotine and restoring it to its original color, white? A. Wrap in a cloth and heat in an oven or over a stove to about 300° Fah. Do not apply a high heat.

(2930) W. D. B. asks: What is the best and cheapest formula for blue fire? A. The well known Bengal light is thus made: Saltpeter 6 parts, sulphur 2 parts, sulphide of antimony 1 part. Each must be separately powdered if necessary and then intimately mixed. The light is only bluish. The following is advantageous, as not containing sulphur: Ammoniacal sulphate of copper 6 parts, chlorate of potash 6 parts, powdered shellac 1 part.

(2931) J. W. D. asks: Please inform me if there are six steamships that use between 300 and 400 tons of coal in 24 hours. A. Here are six: The Etruria, Umbria, Teutonic, City of Paris, City of New York, City of Rome.

(2932) R. M. T. writes: In your answers to querists (No. 2867) you do not give the proportions of boric acid in alcohol. Please name them. A. Use an excess. Add more than the alcohol will dissolve and shake the bottle from time to time.

(2933) A. B. C. asks: Of what is chalk composed? How is it made into the square blocks such as are used on billiard tables, that is, how mixed? A. Chalk is a mineral composed of carbon dioxide and calcium oxide (lime). It is worked by cutting into the desired shape. No heating, baking, or solution is needed.

(2934) G. I. L. asks whether there is an oil manufactured which is thin enough to allow air bubbles to rise through it rapidly and which does not vaporize much when placed in a vacuum. It also cannot be too expensive. A. Use good kerosene or mineral sperm.

(2935) I. S. M. asks: 1. Can the motor described in SUPPLEMENT, No. 641, be converted into a dynamo by a different connection of the wires? And if so, what will be the order of wiring? A. Use a cast iron field magnet, and wind both armature and field magnet with finer wire, say No. 22 or No. 24. 2. Can the dynamo described in SUPPLEMENT, No. 161, be converted into a motor by altering the connections, and if so, by what arrangement? A. The dynamo described in SUPPLEMENT, No. 161, will run well as a motor with a suitable current. 3. Is not the power of a motor due to the attractive and repulsive powers of the magnets in armature and field? A. Yes.

(2936) W. E. T. asks: How can I make and use the salt water bath in making a copying pad? A. Dissolve 2 ounces common salt in 1 pint of water, and use in outer vessel of a glue pot. Place gelatine mixture in the inner vessel.

(2937) E. L. M.—The World's Columbian Exhibition at Chicago is designed to open in April and close in October, 1893, but there will be a preliminary celebration in October, 1892, to mark the 400th anniversary of the New World discovery by Columbus, in 1492. The best time to visit the fair, in a general way, for one living at a long distance from Chicago, will probably be about the last of August or early in September, 1893, after the usual period of hottest summer weather, and when all matters pertaining to the management of the exhibition have become settled.—H. During several hundred years many of the best informed men in the world have been looking for the discovery of a practical method of navigating the air; we are not very confident that it will now be achieved at an early day, yet the possibilities of success in this direction seem to be steadily increasing with the new discoveries of every year.

(2938) C. E. E. asks: 1. Has there been anything yet found to make the flame of a kerosene light more brilliant than the oil itself can produce? A. Camphor is sometimes added, but it is not very effectual. A jet of oxygen can be used, with the effect of whitening and brightening the flame. This is the well known "Bude light." 2. Will you give an account in the SCIENTIFIC AMERICAN of what has been discovered thus far in the Antartic seas toward the South

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pole? A. But little has been observed there. There is a continent probably, and there are volcanoes, one at least an active one. The prospects for an expedition thither are now very favorable.

(2939) J. B. G. asks how to treat water that has alkali in it so that it will not taste of the alkali, and be fit to use for drinking. A. It depends on the alkaline matter which is present. Boiling is sometimes efficacious, or the same result may be attained by adding the proper amount, to be determined for each case, of lime water. Its effects on the system, if used without treatment, cannot be told without analysis, and even then they will vary with different persons.

(2940) W. H. M.—The number of feet per ohm of copper wire of the sizes given is as follows (Am. W. G.):

No.	14	16	20	22
Feet per ohm.	380·51	239·32	94·65	59·53
No.	25	28	32	36
Feet per ohm.	29·69	14·81	5·86	2·32

(2941) A Reader asks if soap has ever been successfully made from petroleum and soda. A. It has never been done. Petroleum oil can be mixed with soap, but will not serve as a basis.

(2942) W. A. K. asks for an article that is pliable yet tough, similar to rubber, that will stand hot water or steam. A. Leather will stand for some time. A proper grade of India rubber would be best.

(2943) L. K. P. asks if there is any acid of any kind used in the making of ice, so that there would be any remaining in the ice. If so, what kind is it, and is it injurious to a person using the ice? A. No. Any chemicals used are kept absolutely separate from the ice. Artificial ice is perfectly healthy and pure.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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March 24, 1891,

AND EACH BEARING THAT DATE.

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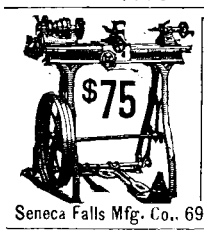

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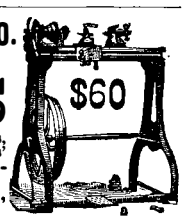

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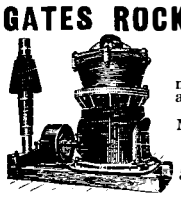

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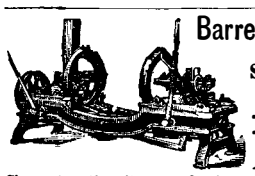

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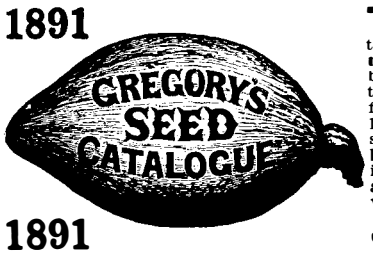

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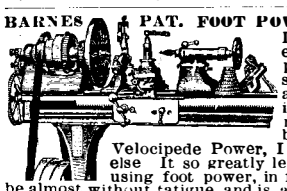

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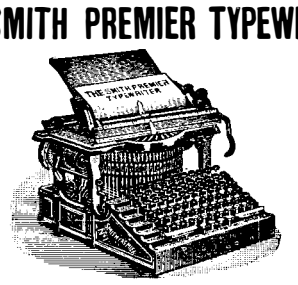

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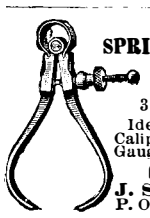

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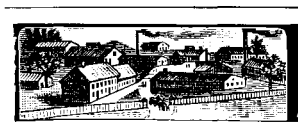

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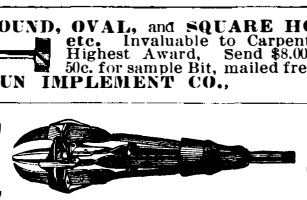

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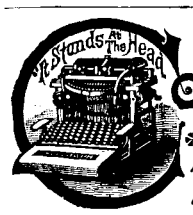

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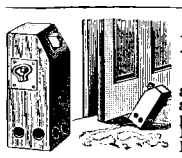

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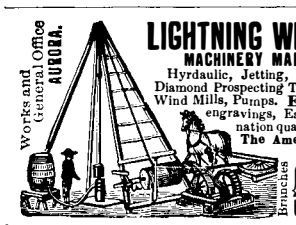

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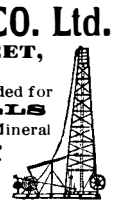

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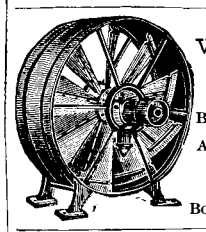

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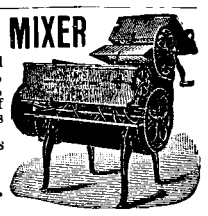

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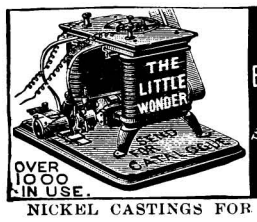

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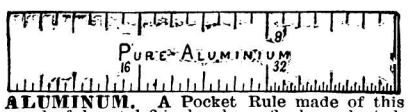

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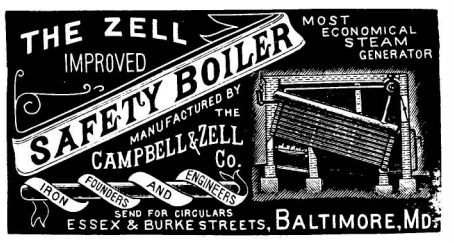
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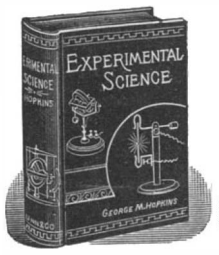

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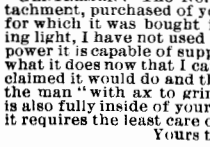

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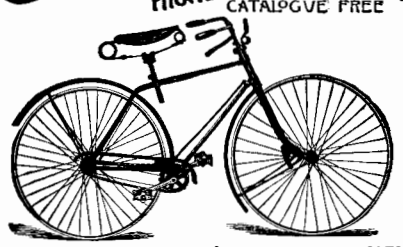

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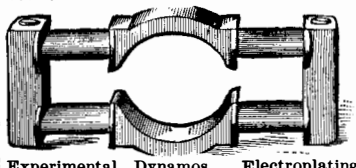

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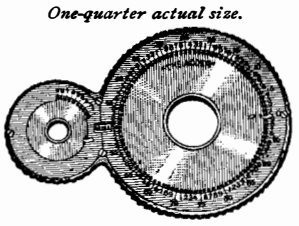

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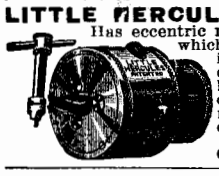

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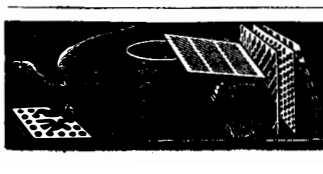

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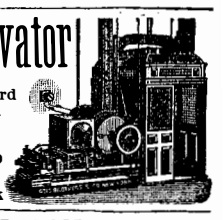

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